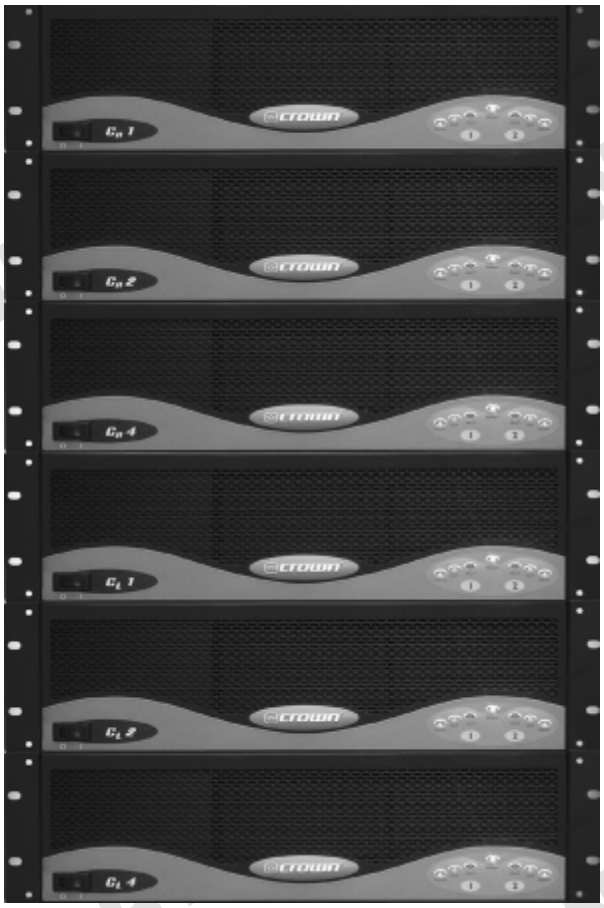
Contractor Series
REFERENCE MANUAL



Models:
CH1, CH2, CH4
CL1, CL2, CL4

Some models may be exported under the name *Amcron*®.

Note on Preliminary Status: Crown continues to stand behind its products as guaranteed to meet or exceed published specifications. However, at the time of this manual's publication, not all of the CH and CL models were in production. Guaranteed specifications for all CH and CL models will be issued at the time of product release.

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Obtaining Other Language Versions:
To obtain information in another language about the use of this product, please contact your local Crown Distributor. If you need assistance locating your local distributor, please contact Crown International at 219-294-8200.

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Important Safety Instructions

1) Read these instructions.
2) Keep these instructions.
3) Heed all warnings.
4) Follow all instructions.
5) Do not use this apparatus near water.
6) Clean only with a dry cloth.
7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10) Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11) Only use attachments/accessories specified by the manufacturer.

12) Use only with a cart, stand, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13) Unplug this apparatus during lightning storms or when unused for long periods of time.
14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15) To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.

THREE YEAR FULL WARRANTY

WORLDWIDE

SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown[1] product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship, and we further warrant the new Crown product regardless of the reason for failure, except as excluded in this Crown Warranty.

[1] *Note: If your unit bears the name "Amcron," please substitute it for the name "Crown" in this warranty.*

ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers. We will remedy the defect and ship the product from the service center within a reasonable time after receipt of the defective product at our authorized service center.

HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by our authorized service center. If the repairs made by our authorized service center are not satisfactory, notify our authorized service center immediately.

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT.

WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER

No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.

9/90

Telephone: 219-294-8200. Facsimile: 219-294-8301

NORTH AMERICA

SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship. We further warrant the new Crown product regardless of the reason for failure, except as excluded in this Warranty.

ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at the factory. We will remedy the defect and ship the product from the service center or our factory within a reasonable time after receipt of the defective product at our authorized service center or our factory. All expenses in remedying the defect, including surface shipping costs in the United States, will be borne by us. (You must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack, which, if needed, may be obtained from us free of charge. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by us or our authorized service center. If the repairs made by us or our authorized service center are not satisfactory, notify us or our authorized service center immediately.

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. **SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER

THIS CROWN WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.

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The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If your unit bears the name "Amcron," please substitute it for the name "Crown" in this manual. If you need special assistance beyond the scope of this manual, please contact our Technical Support Group.

Crown Audio Technical Support Group

Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.

Phone: **800-342-6939** (North America, Puerto Rico and Virgin Islands) or 219-294-8200

Fax: 219-294-8301 Fax Back (North America only): 800-294-4094 or 219-293-9200

Fax Back (International): 219-294-8100 Internet: http://www.crownaudio.com

CAUTION

RISK OF ELECTRIC SHOCK DO NOT OPEN

TO PREVENT ELECTRIC SHOCK DO NOT REMOVE TOP OR BOTTOM COVERS. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL. DISCONNECT POWER CORD BEFORE REMOVING REAR INPUT MODULE TO ACCESS GAIN SWITCH.

AVIS

RISQUE DE CHOC ÉLECTRIQUE N'OUVREZ PAS

À PRÉVENIR LE CHOC ÉLECTRIQUE N'ENLEVEZ PAS LES COUVERCLES. IL N'Y A PAS DES PARTIES SERVICEABLE À L'INTÉRIEUR. TOUS REPARATIONS DOIT ETRE FAIRE PAR PERSONNEL QUALIFIÉ SEULMENT. DÉBRANCHER LA BORNE AVANT D'OUVRIR LA MODULE EN ARRIÈRE.

WARNING

TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE!

Magnetic Field

CAUTION! Do not locate sensitive high-gain equipment such as preamplifiers or tape decks directly above or below the unit. Because this amplifier has a high power density, it has a strong magnetic field which can induce hum into unshielded devices that are located nearby. The field is strongest just above and below the unit.

If an equipment rack is used, we recommend locating the amplifier(s) in the bottom of the rack and the preamplifier or other sensitive equipment at the top.

WATCH FOR THESE SYMBOLS:

The lightning bolt triangle is used to alert the user to the risk of electric shock.

The exclamation point triangle is used to alert the user to important operating or maintenance instructions.

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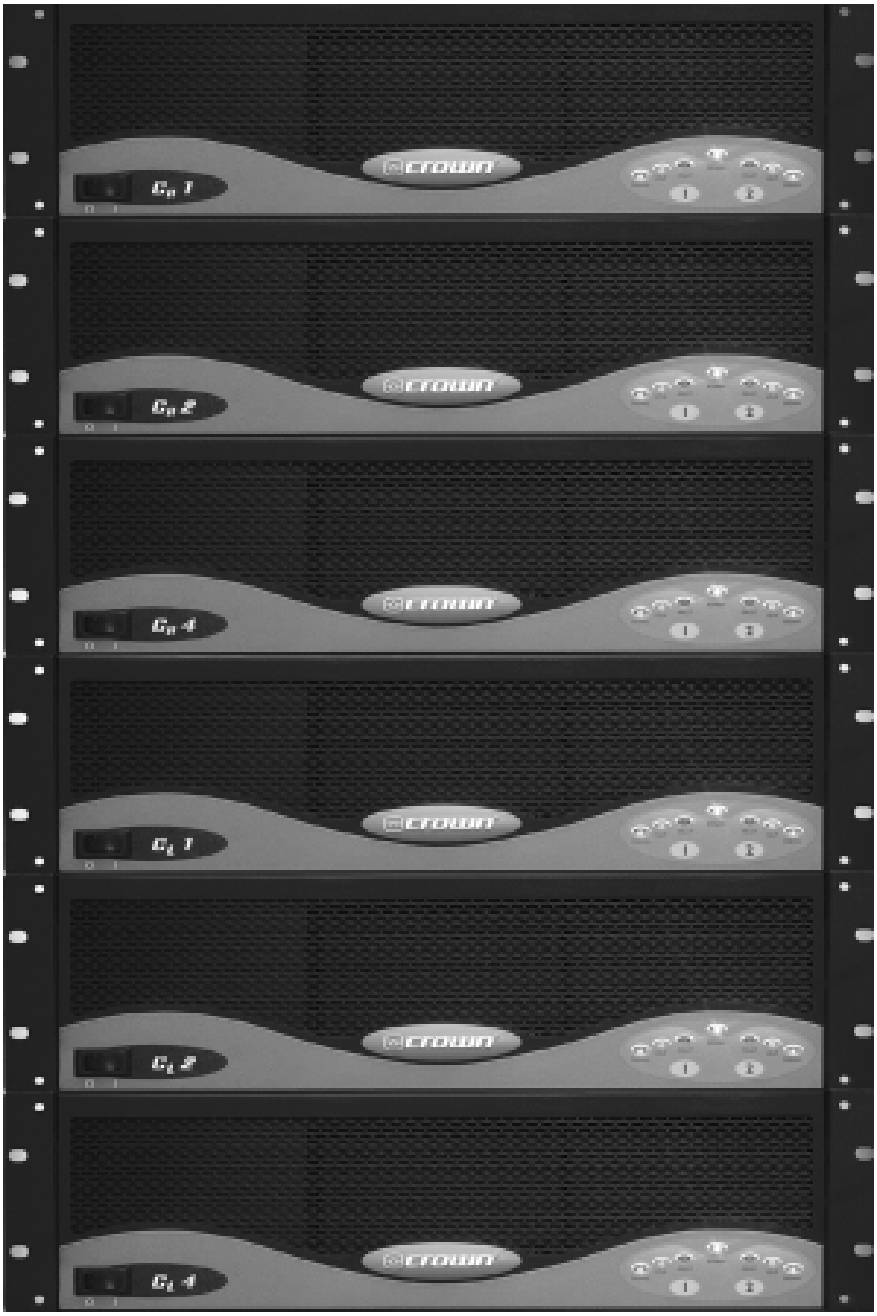


Figure 1.1 Contractor Series Amplifiers

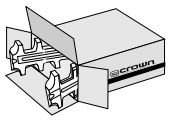
1 Welcome

Congratulations on your purchase of a *Contractor Series* commercial power amplifier. The Contractor Series is a complete family of amplifiers with a wide range of power output capabilities and output configurations. CH Series amplifiers can directly drive "constant voltage" lines, so you can avoid the expense of adding step-up transformers for distributed loudspeaker systems. CL Series amplifiers offer low-impedance compatibility for applications where high-power, low-impedance loads are the primary requirement.

All Contractor Series amplifiers feature Crown's exclusive *SST* (System Solutions Topologies) expansion system. The SST expansion system makes it easy to tailor your amplifier to a specific application or to add future technology as it develops (see Section 5.3 for descriptions of available SSTs).

Your Contractor Series amplifier is also covered by Crown's advance-replacement, Profit Protection Plan, an enhancement to Crown's exceptional Three-Year, No-Fault, Full Warranty. Crown's Profit Protection Plan guarantees quick, no-questions-asked replacement of your covered Contractor Series amplifier should it fail at any time during the original 3-year warranty period following the date of original purchase.

This manual will help you successfully install and use your new Contractor Series amplifier. Please read all instructions, warnings and cautions. Be sure to read Section 3.2 if you plan to use the amplifier in Bridge mode, or if you plan to drive "constant voltage" lines. Also, for your protection, please send in your warranty registration card today, and save your bill of sale as it is your **official proof of purchase**.



1.1 Unpacking

Please unpack and inspect your new amplifier for any damage that may have occurred during transit. If damage is found, notify the transportation company immediately. Only you, the consignee, may initiate a claim for shipping damage. Crown will be happy to cooperate fully, as needed. Save the shipping carton as evidence of damage for the shipper's inspection.

Even if the unit arrived in perfect condition, (as most do), save all packing materials, so you will have them if you ever need to transport the unit. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**

1.2 Features

The Contractor Series amplifiers are designed specially for fixed installation, and include the following features:

- ❑ CH Series provides for both low impedance and high impedance loads, with the choice of 4/8 ohm or 70V operation for each channel (CH1 and CH2 also offer 100V operation). The output mode of each channel can be set independently, allowing unique or mismatched loads to be driven by each channel.
- ❑ CH Series includes a 70-Hz high-pass filter for each channel (when used in 70V or 100V mode) providing necessary low-frequency roll-off to eliminate saturation of constant voltage step-down transformers typically used in 70V and 100V distributed systems.
- ❑ CL Series includes high power 2-ohm operation, for jobs where low impedence is the only requirement.
- ❑ A green Signal LED for each channel flashes when a signal is present at the input.
- ❑ A red Clip LED for each channel turns on when distortion becomes audible in the amplifier output.
- ❑ A red five-way Fault LED for each channel blinks during amplifier power-up, and upon the following fault conditons: excessive heatsink temperature; transformer thermal protection; short at amplifier output; output stage non-operational.
- ❑ An RJ11 connector allows external circuits to monitor the status of the Fault circuit.
- ❑ Precision detented level controls are located on the back panel for security, and allow for accurate level settings.
- ❑ Barrier strip output connectors allow for quick easy connection regardless of the load, and accept up to 10 AWG crimp-on terminal forks.
- ❑ SST modules provide flexible input options, such as onboard crossover configurations.
- ❑ Stereo/Bridge switch allows conversion from Stereo mode to Bridge mode for higher-powered single-channel operation.
- ❑ Advanced protection circuitry guards against: shorted outputs, open circuits, DC, mismatched loads, general overheating, high frequency overloads and internal faults.
- ❑ Mounts in standard 19-inch (48.3-cm) equipment racks.
- ❑ Three year, "No-Fault," Full warranty completely protects your investment and guarantees its specifications.
- ❑ Crown's advance-replacement Profit Protection Plan provides quick, no-questions-asked replacement of covered amps.

2 Controls, Indicators and Connectors

Figure 2.1 Contractor Series Front Panel Controls and Indicators

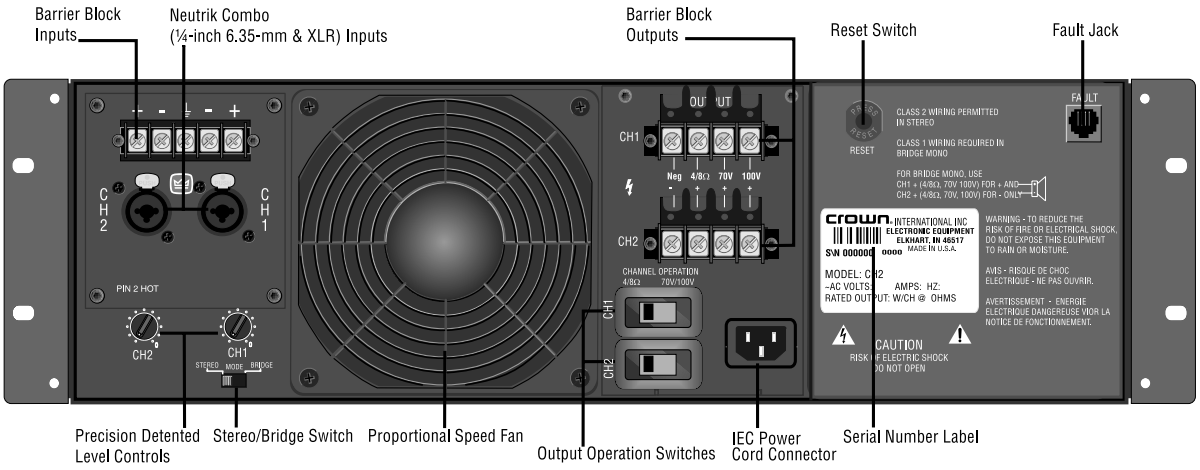


Figure 2.2 CH1 & CH2 Back Panel Controls and Connectors

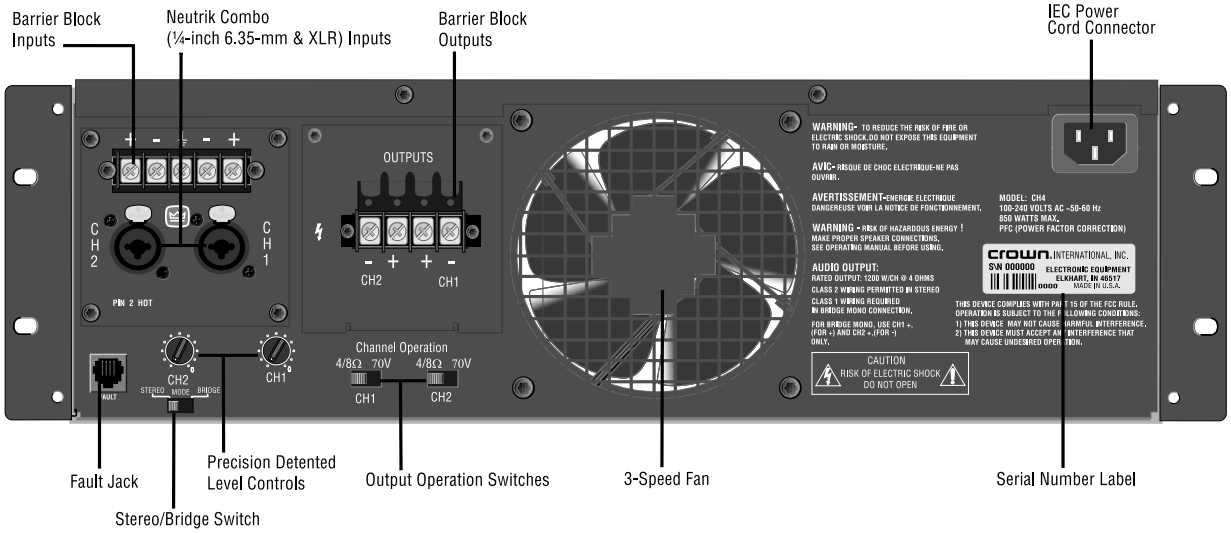


Figure 2.3 CH4 Back Panel Controls and Connectors

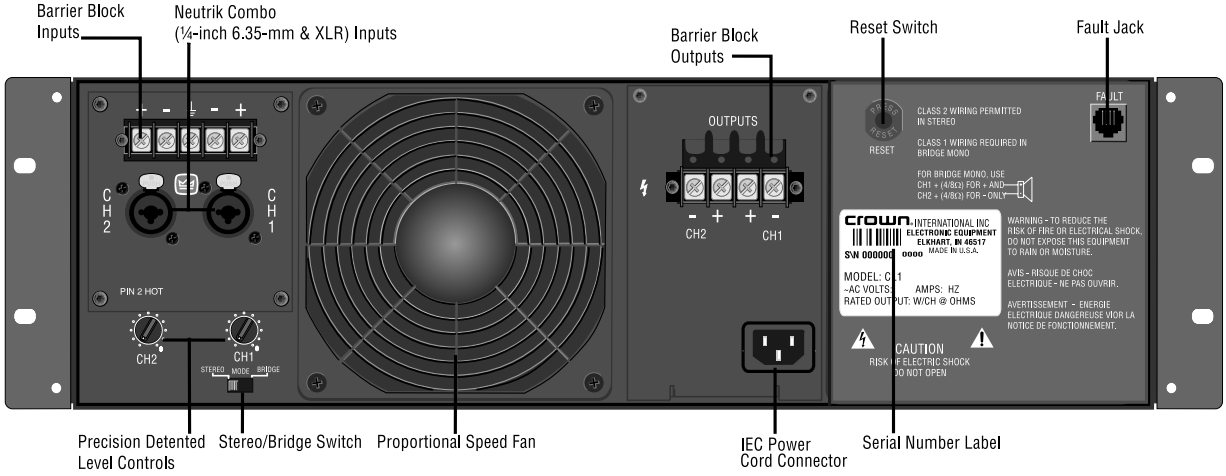


Figure 2.4 CL1 & CL2 Back Panel Controls and Connectors

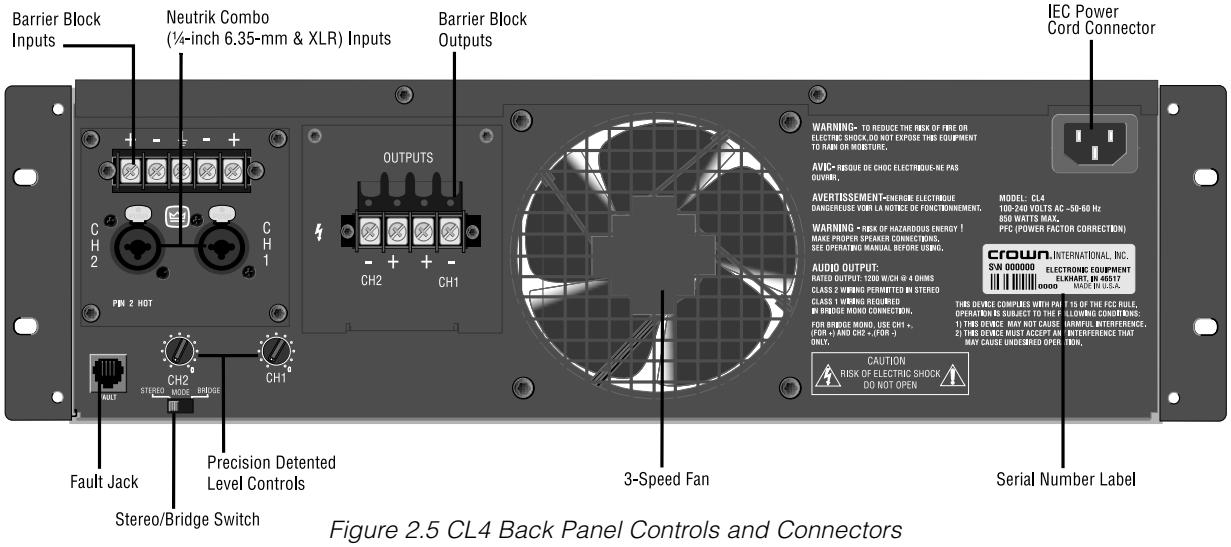


Figure 2.5 CL4 Back Panel Controls and Connectors

3 Installation

This section covers basic Contractor Series installation procedures. **All Contractor Series amplifiers are intended for rack mount installations using a commercial 19-inch (48.3-cm) EIA rack standard metal cabinet wired with a commercial grade electrical outlet box and receptacles. Contractor Series amplifiers utilize a 3-foot (1-meter) power cord for such installations. Do NOT use extension cords.**

Begin with the amplifier turned off and disconnected from the power receptacle. The Contractor Series power switch is located on the left side of the front panel; it is OFF when depressed on the left. Equipment that will be connected to the inputs of the amplifier (such as mixers,equalizers or signal processors) should also be turned off.

3.1 Mounting

Contractor Series amplifiers are designed for standard 19-inch (48.3-cm) equipment rack mounting, or stacking without a cabinet. In a rack, it is best to mount units directly on top of each other. This provides the most efficient air flow and support. If the amplifier(s) will be mounted in an enclosed rack, assure there is adequate ventilation (see Section 9.1 for more information on cooling). If the rack will be transported, we recommend that you fasten the amplifier's back panel securely to the rack to help support the unit's weight.

As you can see in Figure 3.1, Contractor Series amplifiers vary in their depth demensions. Figure 3.1 shows the physical demensions of all models. The depths for Contractor Series models are also listed here:

CH1, CH2, CL1 and CL2 Depth: 12.5 inches (31.11 cm)

CH4 and CL4 Depth: 16.25 inches (36.56 cm)

3.2 Wiring

Proper wiring depends on how you configure your amplifier. First, the Output Mode for each output channel can be independently configured to drive step-down transformers in a distributed "constant voltage" loudspeaker system (70V/100V operation with CH1 and CH2 only, or 70V operation with CH4 only) or loudspeakers that do not have step-down transformers (4/8 ohm mode). Second, the amplifier can be configured for Dual or Bridge modes. Various combinations of these modes are possible, so be sure to note any special wiring requirements for the mode you will be using.

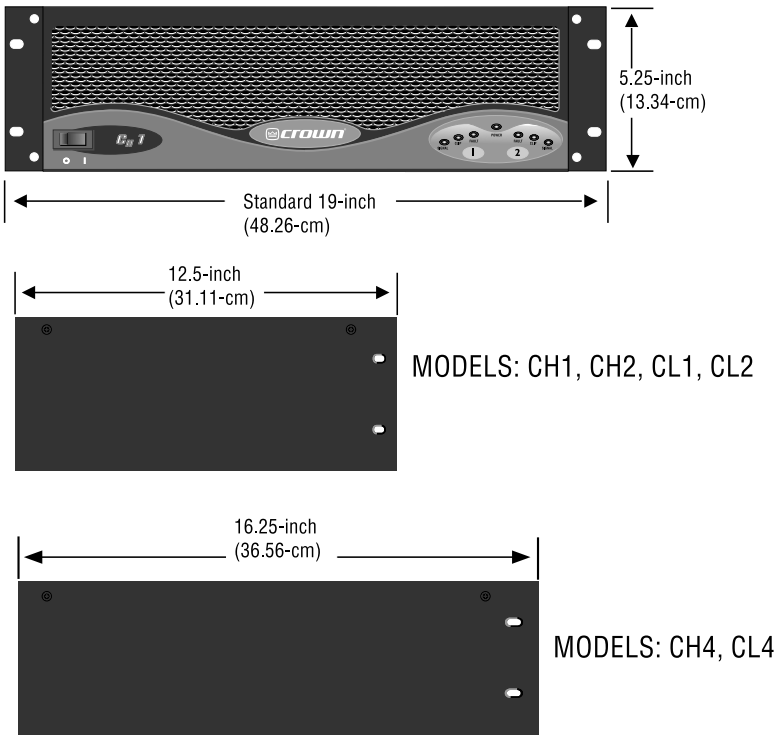


Figure 3.1 Mounting Dimensions

Contractor Series amplifiers can be configured for either Stereo (dual channel) or Bridge (single mono channel) modes of operation. To switch your amplifier accordingly, set the recessed "Stereo/Bridge" switch to the desired setting as shown in Figure 3.2. For Stereo operation, slide the swtch to the left, and for Bridge operation, slide the switch to the right.

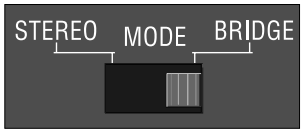
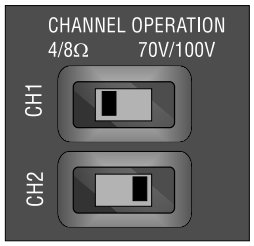
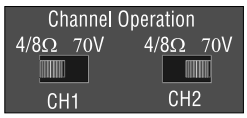


Figure 3.2 Stereo/Bridge Switch

CH Series amplifiers only: select 4/8 ohm, 70V or 100V operation as appropriate for your application and your amplifier. CH1 and CH2 amplifiers allow 4/8 ohm, 70V or 100V operation, and CH4 amplifiers allow 4/8 ohm and 70V operation. Select output operation by sliding the recessed Output Operation switches to the desired position as shown in Figure 3.3. For 4/8 ohm operation, slide the switch all the way to the left, for 70V or 100V operation, slide the switch all the way to the right.



CH1 and CH2 Models



CH4 Model

Figure 3.3 4/8 ohm, 70V/100V Operation Switches

When the CH Series amplifier is set up for two-channel (Stereo mode) operation, it is possible to configure the output channels for any combination of 4/8 ohm, 70V or 100V operation.

WARNING: If Bridge mode is used with 70V output, the amplifier will actually deliver 140 volts, or if used with 100V output, the amplifier will actually deliver 200 volts.

WARNING: The two Output Operation switches must be set to identical positions (4/8 ohm or 70V/100V mode) when operating in Bridge mode. Never change switch positions with power turned on.

CAUTION: Output Terminals are activated by selection of an output operation mode via the Output Operation switches. All other Output Terminals are inactive. For example, when 4/8 Ohm Operation is selected, the 70V and 100V connections are inactive, with no audio present at those Output Terminals.

Figures 3.4 through 3.11 on the following pages show common ways to install Contractor Series amplifiers in a sound system. Input and output terminals are located on the back panel. Please use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own! Crown assumes no liability for damaged loads resulting from careless amplifier use or deliberate overpowering.

CAUTION: Always disconnect the AC power and turn the level controls off when making or breaking connections. This is very important when loudspeakers are connected because it reduces the chance of loud blasts that can cause loudspeaker damage.

CAUTION: Never tie an amplifier's outputs together directly while in Stereo mode. Never parallel them with the output of another amplifier. Such connections do not result in increased output power, but may cause overheating and premature activation of the protection circuitry.

Note: The Channel 2 input jack and Input Level control are not defeated in Bridge mode. A signal feeding Channel 2 will work against the Channel 1 signal, and usually results in distortion and inefficient operation.

3.2.1 Input Wiring

The balanced inputs have a nominal impedance of 20 k ohms (10 k ohms unbalanced) and will accept the line-level output of most devices. The factory installed SST module provides a balanced three-terminal barrier block and a Neutrik® Combo XLR/phone connector for each input. Various SSTs are also available which provide a range of input signal processing features (See Section 5.3).

You can choose to use either balanced or unbalanced wiring. Balanced wiring offers the most rejection of interference, and is typically preferred, especially for long cable runs. See Section 9.2 for more information about balanced and unbalanced input wiring.

3.2.2 Output Wiring

Consider the power handling capacity of your load before connecting it to the amplifier. Fusing loudspeaker lines is highly recommended (see Section 9.4.2).

Contractor Series amplifier output connectors accept up to 10 AWG crimp-on terminal forks. Use high-quality cable, with sufficient gauge for your application. See Section 9.4 for tips on choosing speaker cable.

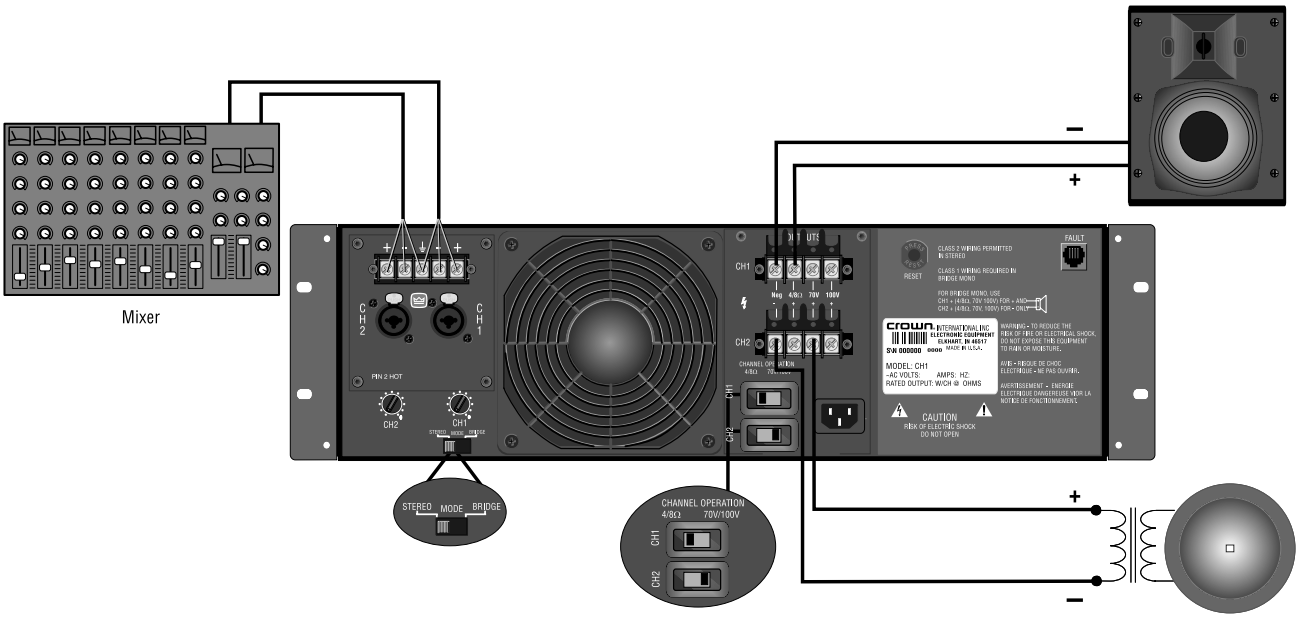


Figure 3.4 CH1 & CH2 Wiring for Stereo Mode

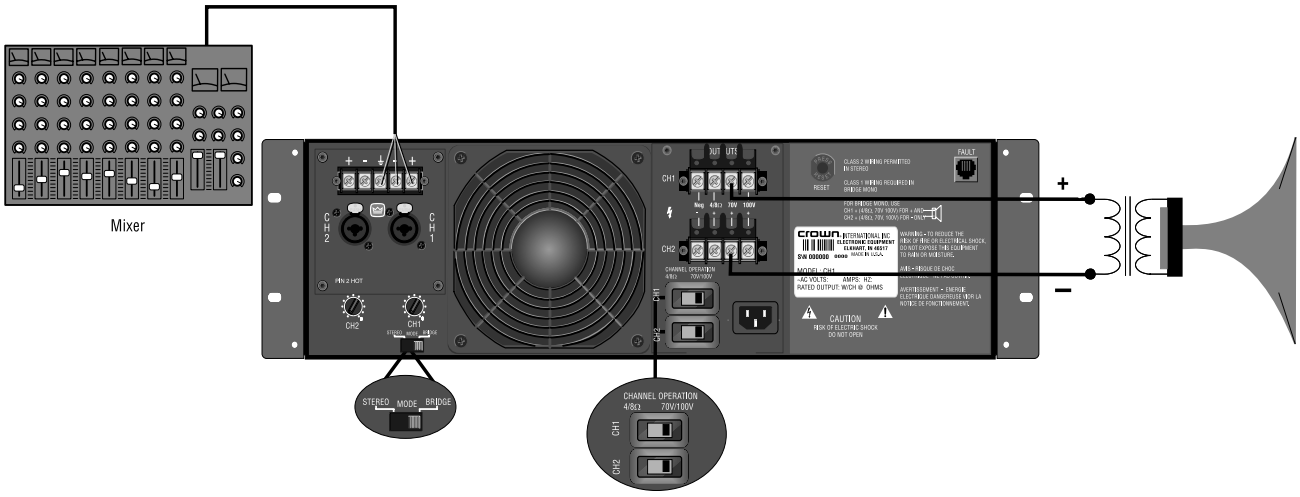


Figure 3.5 CH1 & CH2 Wiring for 140V Bridge Mode

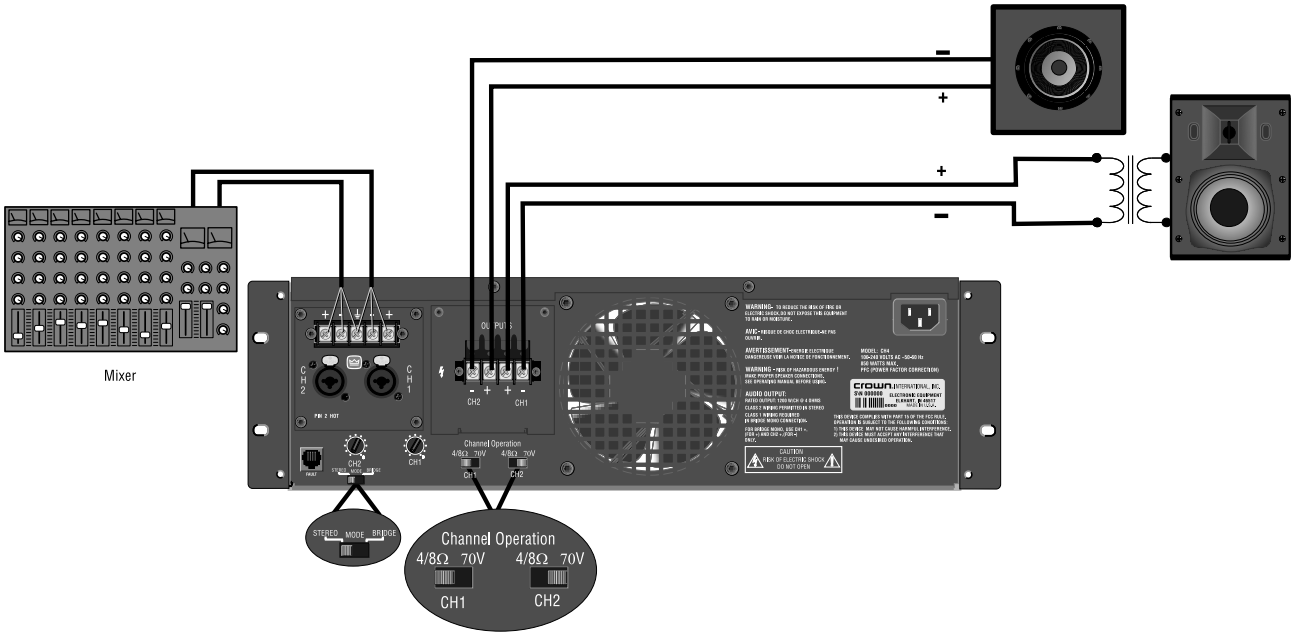


Figure 3.6 CH4 Wiring for Stereo Mode

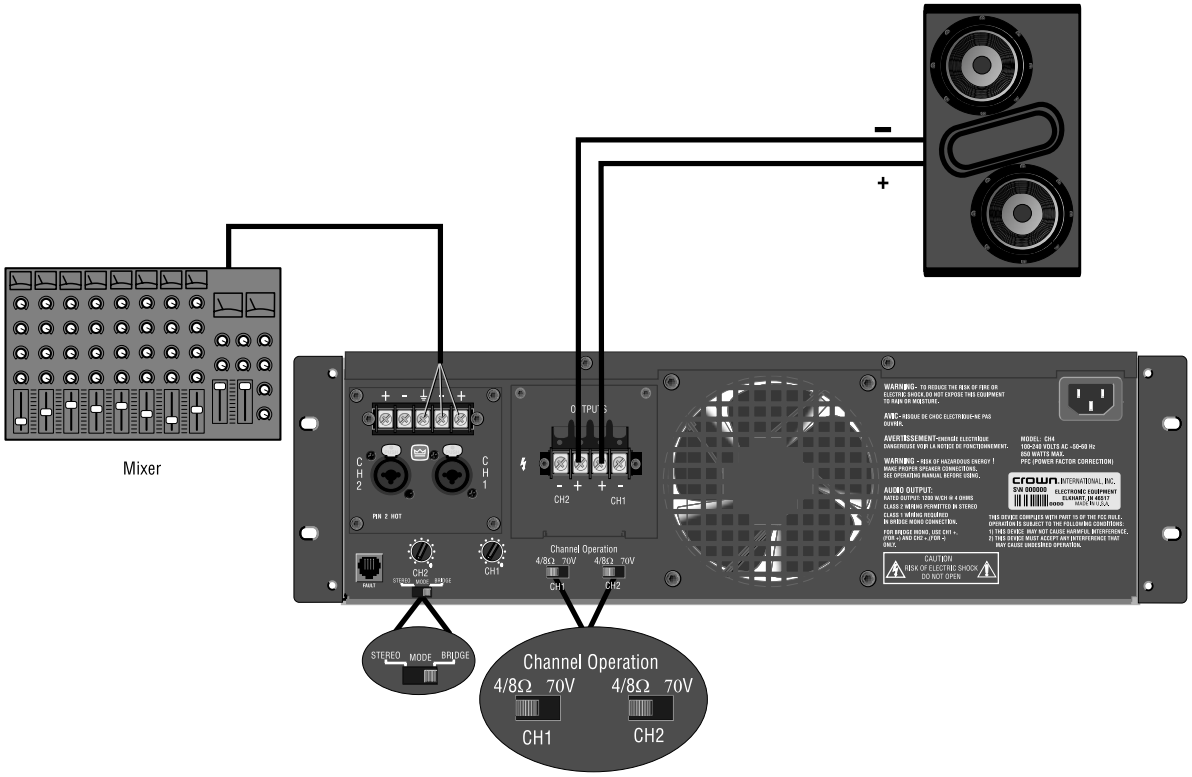


Figure 3.7 CH4 Wiring for Bridge Mode

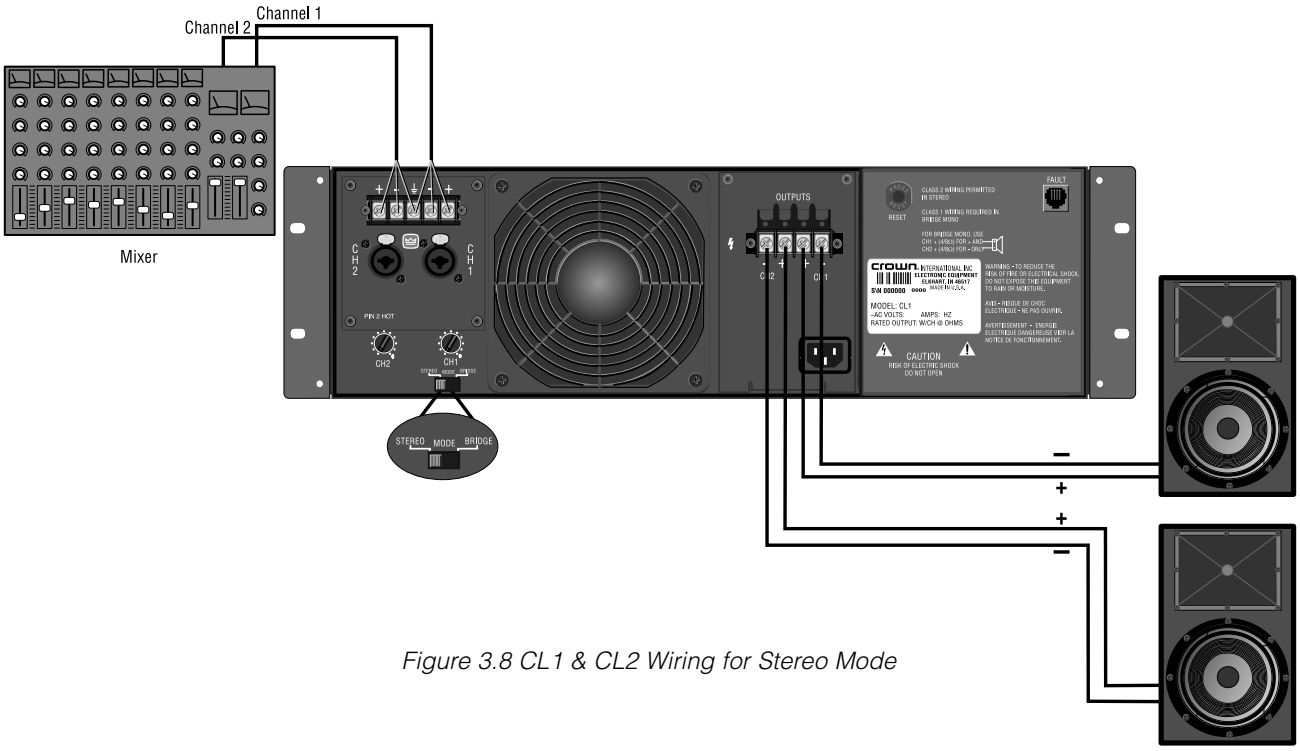


Figure 3.8 CL1 & CL2 Wiring for Stereo Mode

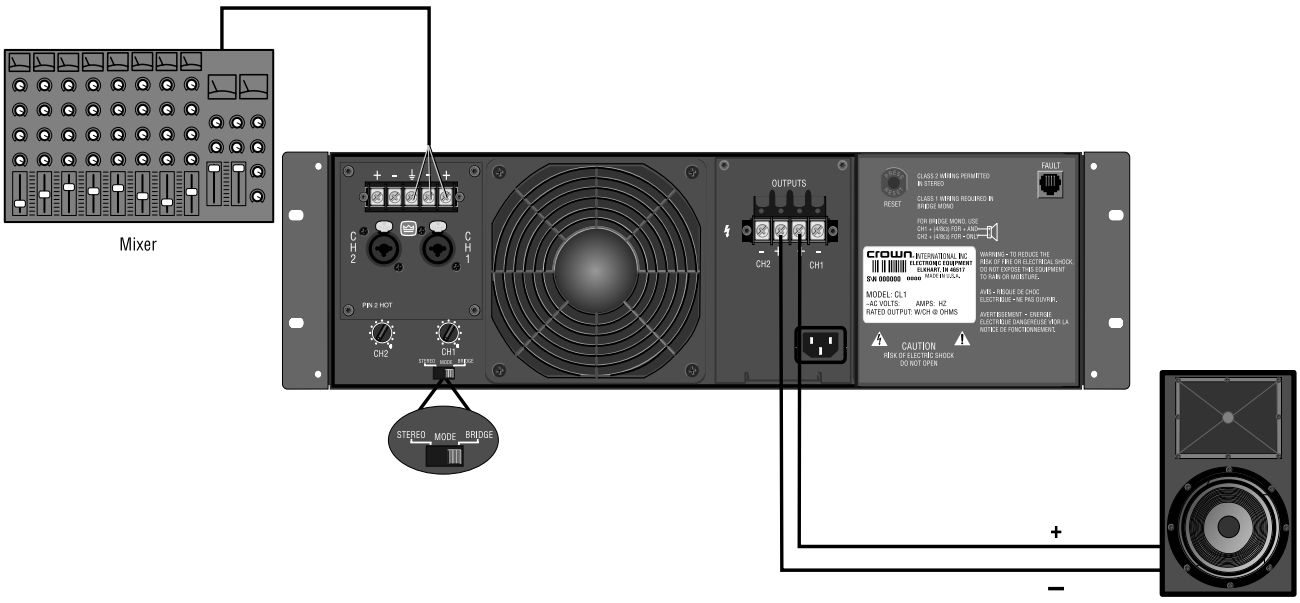


Figure 3.9 CL1 & CL2 Wiring for Bridge Mode

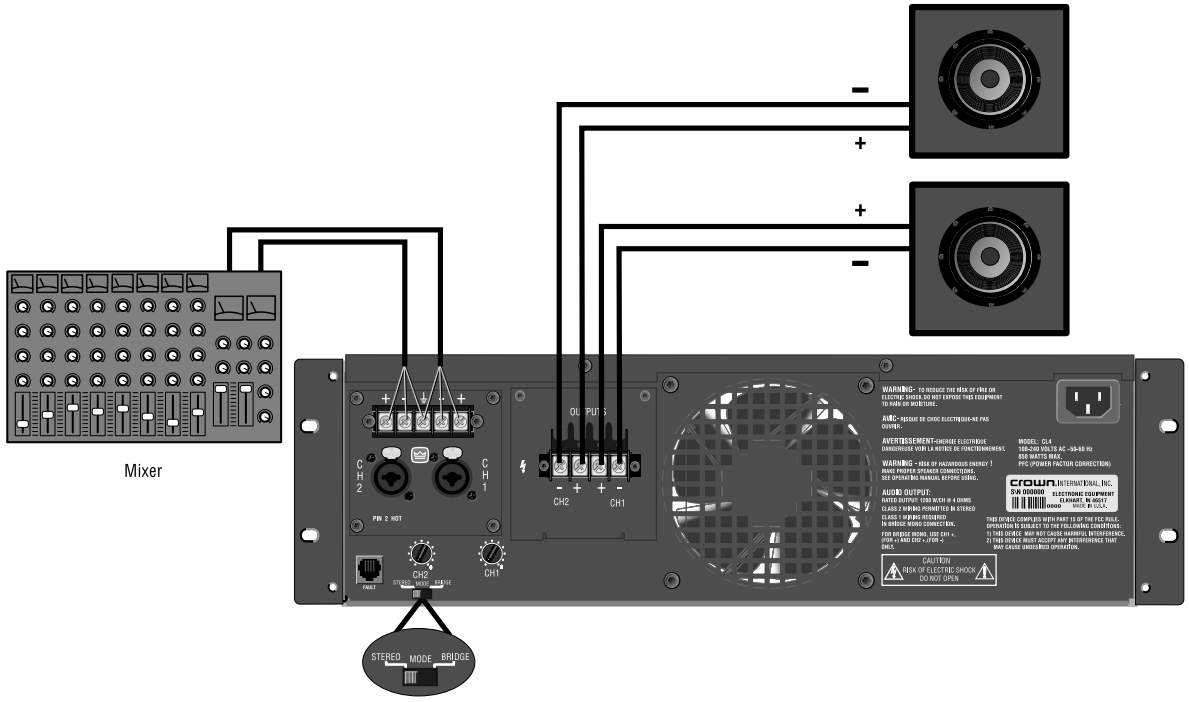


Figure 3.10 CL4 Wiring for Stereo Mode

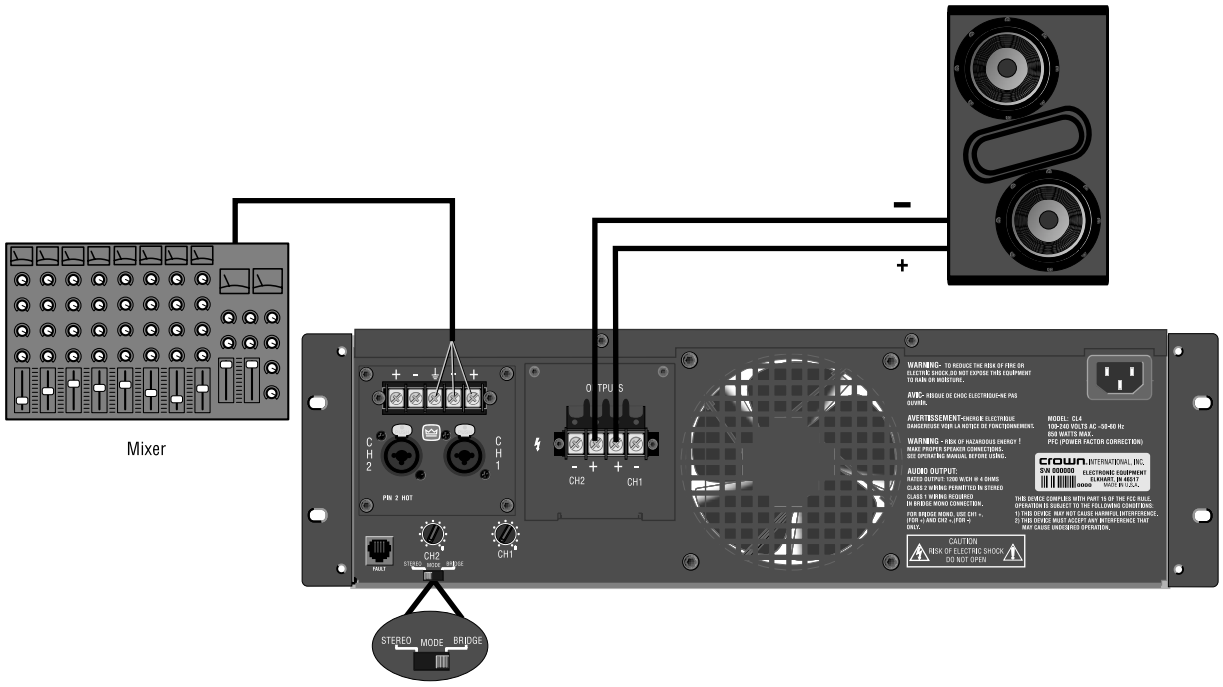


Figure 3.11 CL4 Wiring for Bridge Mode

4 Operation

4.1 Precautions

Contractor Series amplifiers are protected from internal and external faults, but you should still take the following precautions for optimum performance and safety:

1. Improper wiring for the Stereo or Bridge-Mono modes, as well as the 4/8 Ohm, 70V and 100V output modes can result in serious operating difficulties. Refer to Section 9.4 for details.
2. **WARNING: Never operate the amplifier in Bridge mode unless both Output Operation switches are configured identically (4/8 Ohm, 70V or 100V).**
3. **WARNING: Do not change the position of the Stereo/ Bridge switch or the Output Operation switches unless the amplifier is first turned off.**
4. Use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own!
5. Do not connect input and output ground leads together. Ground loops and oscillations may result.
6. **Never connect the output to a power supply output, battery or power main.** Electrical shock may result.
7. Tampering with the circuitry by unqualified personnel, or making unauthorized circuit changes may be hazardous and invalidates all agency listings.

Remember: Crown is not liable for damage that results from overdriving other system components.

4.2 Startup Procedure

Use the following procedure when first turning on your amplifier:

1. Turn down the level of your audio source.
2. Turn down the level controls of the amplifier.
3. Turn on the Enable switch. The Enable indicator should glow. During power-up, the Fault indicators will flash as described in Section 4.3. After power-up, the Fault indicators will turn off and all other indicators should function normally.
4. After the turn-on delay, turn up the level of your audio source to the desired level.
5. Turn up the Input Level controls on the back panel of the amplifier until the desired loudness or power level is achieved.
6. Turn down the level of your audio source to its normal range.

If you ever need to make any wiring or installation changes, **don't forget to disconnect the power cord.**

4.3 Indicators

The front panel of a Contractor Series amplifier has several helpful indicators (Figure 4.1). The blue **Power indicator** shows that the amplifier has been turned on and has power.

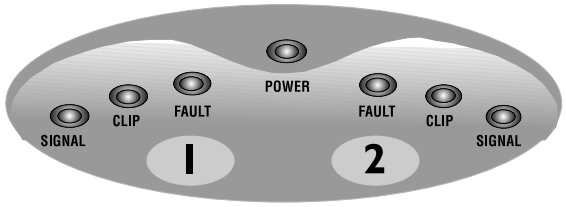


Figure 4.1 Indicators

The red **Fault indicators** blink under five different conditions:

1. When the amplifier is first powered up, until the unit is ready for operation.
2. If the heatsinks reach a temperature above normal working limits. This can be caused by any number of abnormal conditions including but not limited to extremely low load impedance and/or inadequate cooling (see Section 9.1 for more information on cooling).
3. If the transformer (high-voltage power supply) thermal protection circuit is activated. Higher than rated output levels, excessively low-impedance loads and unreasonably high input signals can generate more heat in the power supply than in the output devices. This can overheat the power supply and activate the Fault protection circuit.
4. If amplifier output wires develop a short-circuit. This could be caused by a short anywhere along the circuit from the output connectors to the speakers, including shorted speaker drivers.
5. Should the amplifier output stage become non-operational.

The red **Clip indicators** turn on when distortion is audible in the amplifier output.

Unlike other Crown amplifiers, the green **Signal Presence Indicators** (SPI) on Contractor Series amplifiers illuminate when a signal (>–40 dBm) is present at the **INPUT** of the amplifier. This indicator is before the level control, so it can be used to troubleshoot wiring problems within a system. If the indicators are not lit, signal is not reaching the amplifier.

4.4 Controls

The **Enable switch** is located on the front panel so you can easily turn the amplifier on and off.

A 21-position **Precision Detented Level Control** is provided for each channel. Level attenuation may be adjusted in precise steps. For security, the level controls are located on the back panel. **Input Sensitivity** is factory set for 1.4V for each channel. With this setting, a 1.4V input signal will drive the amplifier to full power into an 8-ohm load when the Level Controls are turned to maximum. This setting works best when the amplifier is being driven by equipment with a +4 dBu output. Optionally, the Input Sensitivity for each channel may be individually set to either 0.775V or 26 dB. To have the input sensitivity changed on your amplifier, contact a Crown authorized servicer (see Section 11) .

A two-position **Mode switch**, located on the back panel, allows the selection of either Stereo or Bridge mode of operation.

Stereo mode provides identical power output to each of the two amplifier output channels. Bridge mode combines the two amplifier output channels into a single mono channel with twice the voltage of a single stereo channel. It does this by bridging the outputs, and it requires special output wiring. **Do NOT select Bridge mode without first making sure the amplifier has been wired in a Bridge-Mono configuration.** For more information on wiring for Bridge mode, see the Installation section of this manual (Section 3), or consult your system installer.

When Bridge mode is selected, only the Channel 1 Level control and the Channel 1 Signal indicator will work. If the Channel 2 input is wired, the Channel 2 Level Control should be turned all the way down (counter/anticlockwise) to prevent distortion.

A two-position **Output Operation switch** (CH Series amplifiers only) allows the selection of either 4/8 ohm, 70V or 100V output from the amplifier. See Section 9 for more information about output operating modes.

Fault Jack: This RJ11 jack (which looks like a phone jack) is located on the back panel. By attaching a signalling device to the Fault jack, you can monitor the amplifier's Fault status from a remote location. See the Advanced Features and Options section (Section 5) of this manual for more information on fault monitoring and suggestions for signalling device circuity.

A circuit breaker is provided to prevent the high-voltage power supplies from drawing excessive current. A **Reset switch** for the circuit breaker is provided on the back panel. If the circuit breaker trips, the Power indicator turns off. In this situation, turn off the Power switch and reset the circuit breaker. Then, turn the Power switch back on. If it trips again or the unit fails to operate properly, contact an authorized service center or Crown's Technical Support Group.

5 Advanced Features and Options

5.1 *BCA*® (CH4 and CL4 Only)

BCA (Balanced Current Amplifier) is Crown's patented, cutting-edge technology that gets more power out of an amplifier with less waste than was ever before possible. A completely new adaptation of standard amplifier design, Crown's BCA "switching" amplifier design provides for high output, exceptional reliability and nearly twice the efficiency of typical amplifier designs.

While switching designs have been used successfully in other applications, these designs were never before suitable for use in precision, high-power audio amplifier applications. Crown's BCA technology changes that, with a totally new paradigm for amplifier design that represents the future of professional amplifiers.

With their superior efficiency, BCA amplifiers can help to keep power requirements lower, while still providing excellent audio reproduction. And Crown BCA amplifiers are tough—easily handling very low (and highly reactive) load impedances, even under extreme conditions. In fact, Crown BCA amps have far out-performed competitive amplifiers in tests where the amplifier was run as much as 12-dB into clip for extended periods of time.

5.2 Switching Power Supply with PFC (CH4 and CL4 Only)

Crown's new Switching Power Supply with PFC provides a range of benefits over both non-switching and conventional switching power-supply designs.

Typical non-switching power supplies require large transformers in order to produce the required power at the output stage. These transformers must be large to absorb the waste that occurs when operating at 50 to 60 Hz (standard AC supplied by the power company).

By contrast, switching power supplies can operate with a much smaller (and lighter) transformer because they first convert the AC up to a much higher frequency, thereby reducing waste.

However, in both non-switching and conventional switching designs, phase differences occur within the power supply due to the inductance of the transformer. This phase difference prevents much of the available power from the AC mains from making its way to the load.

PFC, however, compensates for phase differences in the power supply, allowing more true power to be transferred to the amplifier. The result is more power with less waste than any other conventional switching or non-switching design.

As an added benefit, PFC also allows the amp to be connected to any common AC line voltage, without converting the power supply. This means that the CH4 and CL4 are ready for any common line voltage.

5.3 Crown SST Modules

Crown optional SST (System Solution Topologies) modules were specially designed to improve the fidelity and versatility of your audio system. They feature a variety of professional signal routing and filtering capabilities, with active crossovers that allow the audio signal to be split and sent to auxiliary amplifiers. Your choice of SST modules can be easily added to the amplifier by any authorized Crown Service Center.

For information on wiring and configuration of amplifiers equipped with an optional Crown SST crossover module, please refer to the applicable SST Crossover Reference Manual.

Refer to the following descriptions for an overview of available Crown SST crossover modules.

5.3.1 SST-MX Crossover

The SST-MX crossover module features 24-dB/octave Linkwitz-Riley tuned filters and stereo sub-bass outputs for biamp operation of subs. See Figure 5.1 for SST-MX block diagram.

Features of the SST-MX crossover include:

- Stereo biamp.
- 100-Hz fixed crossover
- 24-dB/octave Linkwitz-Riley tuned filters.
- Neutrik® Combo ¼-inch (6.35-mm) and XLR input jacks.
- Barrier block balanced outputs.
- Optional high-pass filter bypass on amplified outputs adapts system for full-range use.

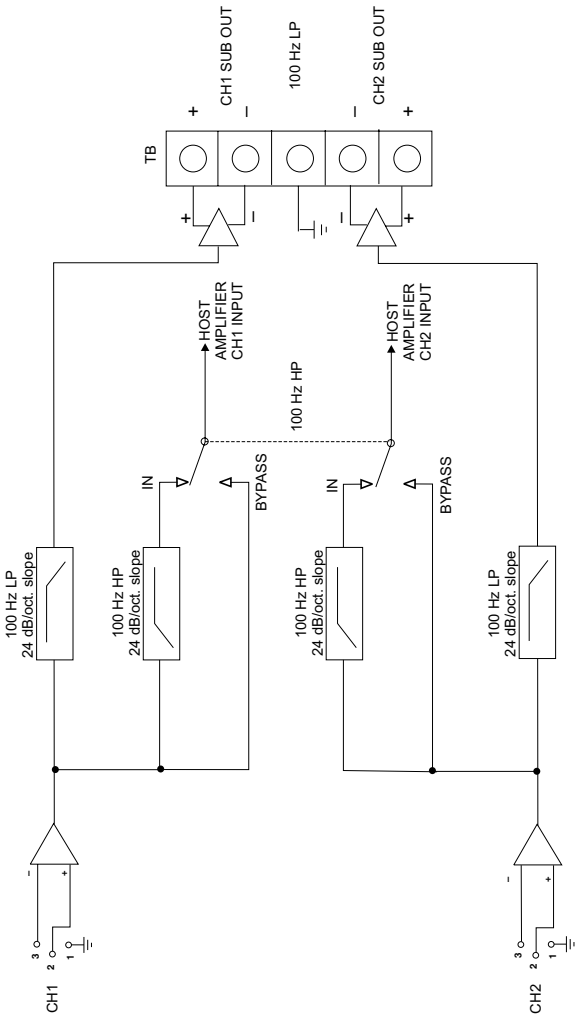


Figure 5.1 SST-MX Crossover Block Diagram

5.3.2 SST-SX Crossover

The SST-SX crossover module features 24-dB/octave Linkwitz-Riley tuned filters and mono-summed sub-bass outputs for biamp operation of subs. See Figure 5.2 for SST-SX block diagram.

Features of the SST-SX crossover include:

- Mono-summed sub-bass output.
- 24-dB/octave Linkwitz-Riley tuned filters.
- Crossover switchable between 80 and 120 Hz.
- Neutrik® Combo (6.35-mm and XLR) input jacks.
- Male 3-pin XLR outputs
- Optional high-pass filter bypass on amplified output adapts system for full-range use.

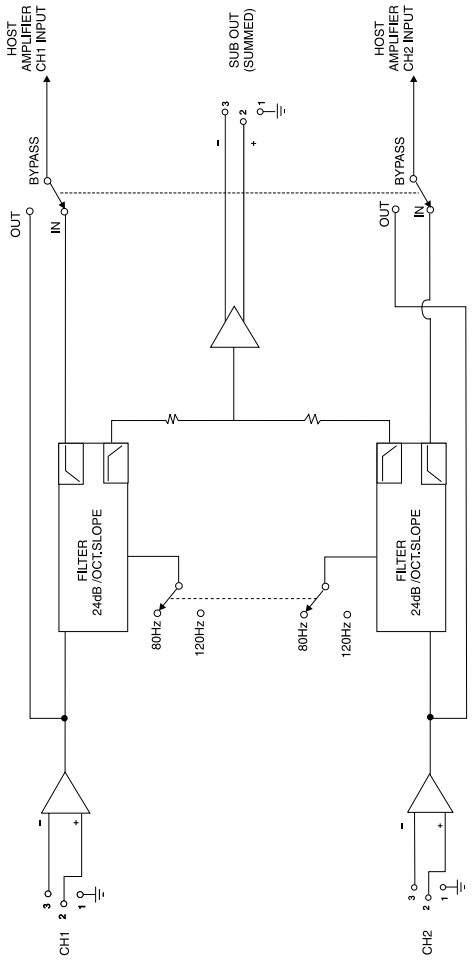


Figure 5.2 SST-SX Crossover Block Diagram

5.3.3 SST-SBSC (Summed Bass Stereo Crossover) Module

Crown's advanced SST-SBSC module offers ten user-specified crossover frequencies, CD horn EQ and summed sub-bass output for driving subs (see Figure 5.3 for block diagram). The SST-SBSC offers the following features:

- Stereo biamp.
- 12-, 18- and 24-dB (Linkwitz-Riley) / octave filters.
- CD horn equalization.
- Mono summing of sub-bass output for driving subs.

Crown plans to release additional accessory plug-in modules offering a range of advanced features and capabilities. Watch for new releases.

5.4 Fault Monitoring

The Fault (RJ11) jack is located on the back of your Contractor Series amplifier. It gives you an easy way to remotely monitor the amplifier's fault status. See Section 9.5 for details about how to connect external circuits to the Fault jack.

5.5 Constant Voltage Computer

Crown's constant voltage computer is an easy-to-use slide rule for audio applications. The first scale finds the impedance of a step-down transformer based on deliv-

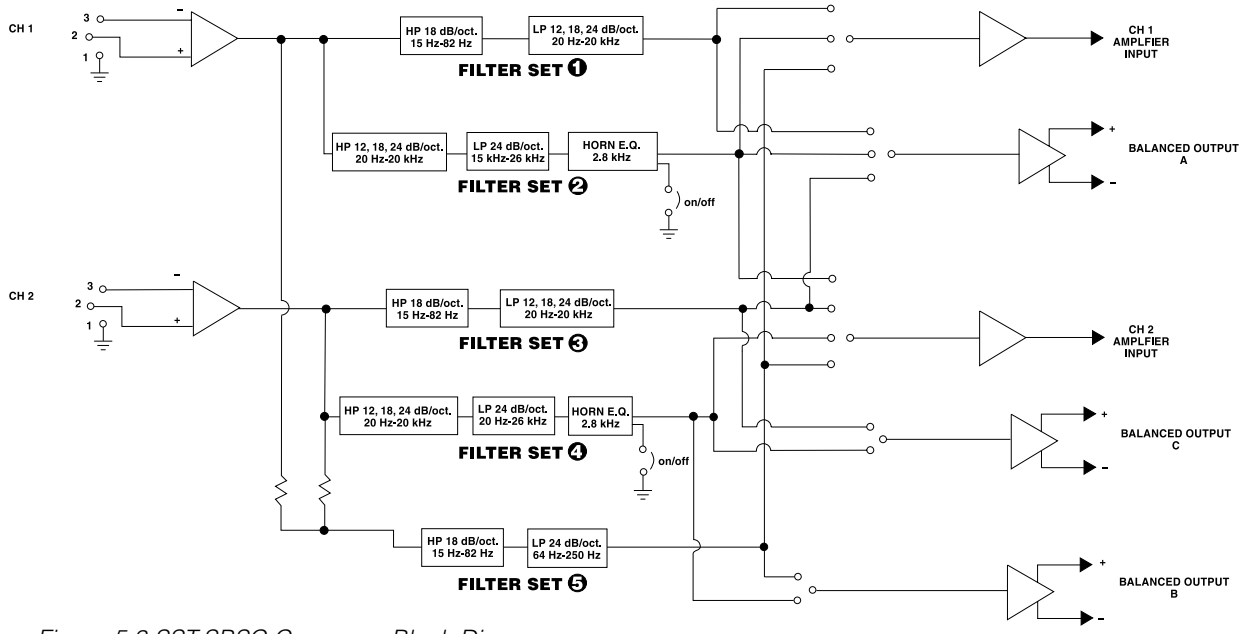

CH 1
HP 18 dB/oct. 15 Hz-82 Hz
LP 12, 18, 24 dB/oct. 20 Hz-20 kHz
FILTER SET ❶
CH 1 AMPLFIER INPUT
HP 12, 18, 24 dB/oct. 20 Hz-20 kHz
LP 24 dB/oct. 15 kHz-26 kHz
HORN E.Q. 2.8 kHz
FILTER SET ❷
on/off
BALANCED OUTPUT A
CH 2
HP 18 dB/oct. 15 Hz-82 Hz
LP 12, 18, 24 dB/oct. 20 Hz-20 kHz
FILTER SET ❸
CH 2 AMPLFIER INPUT
HP 12, 18, 24 dB/oct. 20 Hz-20 kHz
LP 24 dB/oct. 20 Hz-26 kHz
HORN E.Q. 2.8 kHz
FILTER SET ❹
on/off
BALANCED OUTPUT C
HP 18 dB/oct. 15 Hz-82 Hz
LP 24 dB/oct. 64 Hz-250 Hz
FILTER SET ❺
BALANCED OUTPUT B

Figure 5.3 SST-SBSC Crossover Block Diagram

ered power and the transformer's rated voltage. This scale also identifies the proper transformer tap to use when a particular constant voltage rating is not provided with the transformer (such as 25, 35, 50, 70, 100 or 140 volts). Other scales include line loss, parallel resistance, dB-SPL vs. distance and dB-SPL vs. power. To obtain a constant voltage computer, call Crown and ask for literature.

6 Principles of Operation

6.1 CH1, CH2, CL1 and CL2

For the sake of simplicity, only channel one of the amplifier is described.

Signal is presented to the Contractor Series amplifier through one of three connectors when using the standard input module. Each channel is outfitted with a balanced XLR / phone jack, and a barrier strip. These connectors are wired in parallel, which allows daisy chaining when needed. The signal is then converted from balanced to unbalanced in the Balanced Input Stage where it also receives RFI protection. Signal then flows into the Variable Gain Stage where the rear-panel level controls are allowed to affect the gain.

Following this stage, the signal is put under the control of a full-time compressor circuit comprised of a symmetrical window detector, a buffer amplifier, and the gating op amp which uses several small components to set the compressor's attack and decay characteristics. The actual compressing is accomplished by an opto-isolator which affects the gain in the signal path.

The signal then travels either through the HP filter module or is bypassed around it depending on the position of the channel operation switch. In the CH1 and CH2, with the switch set in the 70V/100V position, the filter is enabled. The filter is an 18 dB-per-octave high-pass with a –3 dB rolloff at 70 Hz. This provides a measure of protection to step-down transformers used in distributed speakers installations. With the switch set in the 4/8 Ohm setting, the filter is bypassed.

The signal next enters the main amplifier error amp where it is mixed with a small portion of the output signal in such a way as to control the amplifier's overall output performance.

Following the error amp is the LVA stage, where the low-voltage referenced signal gets translated to the output high-voltage rails. The last voltage amplifier, in conjunction with a bootstrap current source, drives both predrivers and the bias servo. The bias servo is mounted in such a way as to translate the output heatsink temperature into a controlled bias current to prevent thermal runaway and hold the amplifier's notch distortion to a minimum.

The predrivers provide enough signal to activate the drivers, which together operate in the class AB range. For the major output current requirements, the drivers feed the various numbers of paralleled output transistors which operate in a class B mode. This is referred to as the Triple-Deep Darlington Output Stages.

The output transistors are protected by the Time Dependent Voltage & Current circuit. This circuit protects the devices from extending beyond their safe area of

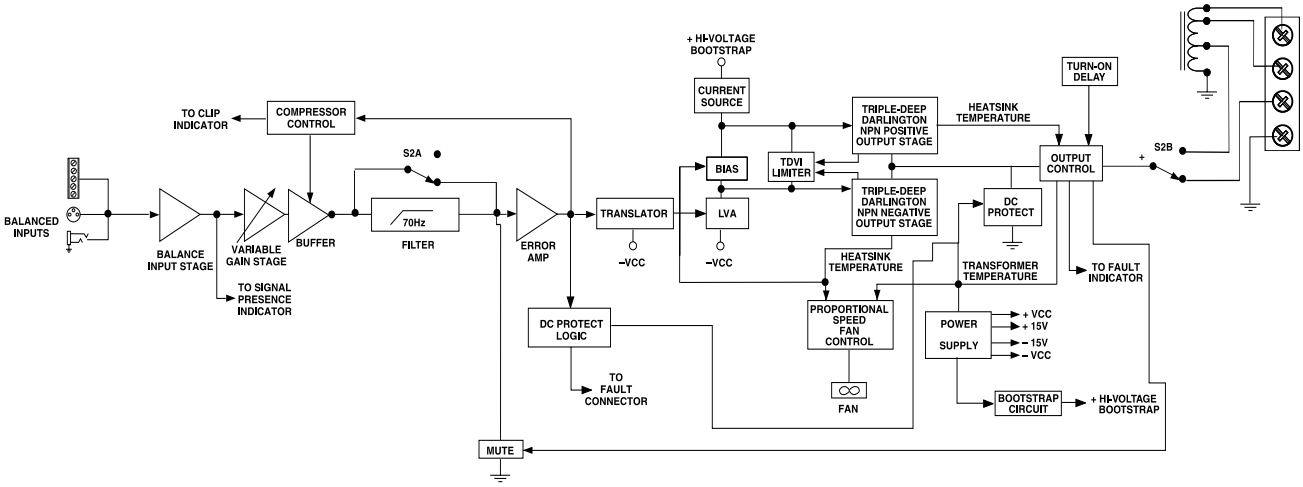


Figure 6.1 CH1 & CH2 Circuit Block Diagram

operation, but allows the devices to provide high bursts of peak power when needed. This amplifier output topology offers a good combination of low quiescent amplifier heating, great distortion performance at high powers, and relative simplicity, with impressive reliability and value.

All output power is delivered through a channel-independent, dead front barrier block on the back panel. When the Channel Operation switch is set to 4/8 Ohm, only the negative and 4/8 ohm connections on the barrier block have audio present. This provides power to low impedance speakers. When the Channel Operation switch is set to 70V/100V, only the negative and 70V and 100V connections on the barrier block have audio present. This provides power to distributed speakers in a high-impedance "constant-voltage" application.

The output relay, in conjunction with input signal mute circuit, assures a quiet turn-on and turn-off. In the event of an amplifier output failure, a triac will activate to turn off the offending channel to protect the speakers.

The turn-on delay circuit functions to keep the output relay open until all the voltages are up and stable, both in the amplifier, and in all the components in the system ahead of the amplifier.

Heatsink temperature is monitored by a thermal probe attached to the heatsink. As the temperature rises, the probe sends a proportional current to the proportional speed fan circuit which starts the fan. Should the power transformer reach its maximum safe temperature, an internal thermal switch opens and the fan circuit turns on full speed to quickly cool down the amplifier. It also disconnects the load via the output relay, removing any output current and further speeding a cool-down cycle. This point is set both to protect speakers and to guard against nuisance tripping.

Whenever the heatsinks or the transformer reach a maximum temperature, or during the normal turn on delay window, the front panel Fault Indicators will blink.

An RJ11 modular jack is mounted on the back panel. Pins 2 and 5 are connected to an opto-isolator which is always in a low-resistance state whenever the unit is on and operational. Should a fault be detected or should the amplifier lose AC power, the opto-isolator will change to a high resistance, allowing the user to remotely detect the status of the amplifier.

The Signal Presence Indicators tap the signal chain just before the level controls and prior to the power amplifier chain. They are not amplifier output indicators and should only be used to indicate the presence of signal at the amplifier front end.

The Clip Iindicator is driven from the output of the compressor circuitry and lights to indicate the onset of audible distortion.

The Power Indicator LED is driven from the low-voltage supply.

A positive and negative regulator form the ±15-volt power supplies. Add to that the main transformer, a full-wave bridge rectifier, and high energy electrolytic to form the main power supply. They are protected by the front-panel line circuit breaker and controlled by the front-panel power switch.

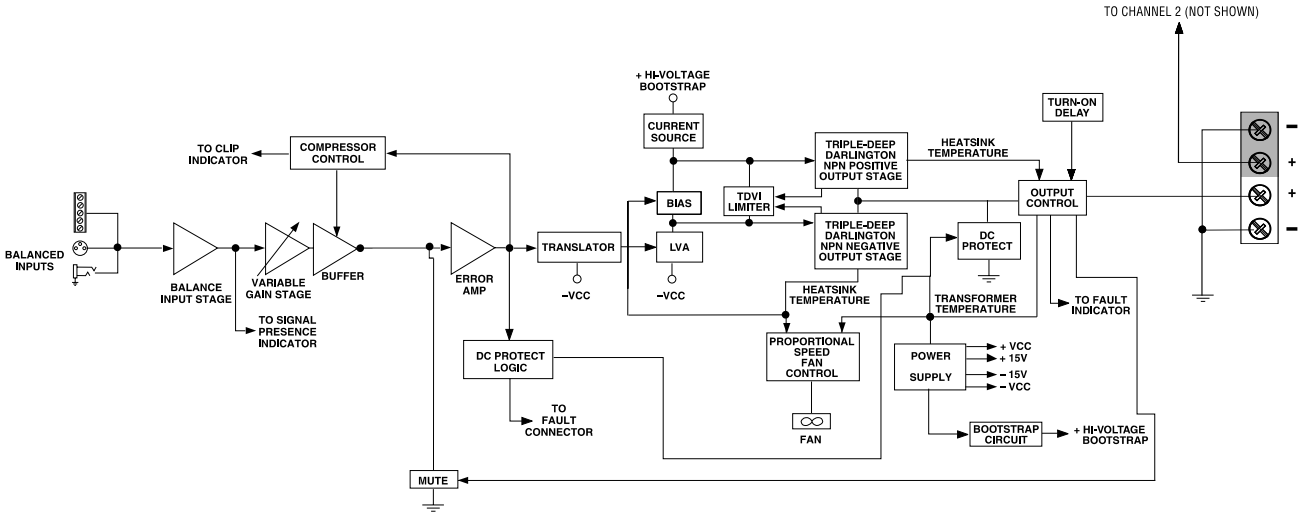


Figure 6.2 CL1 & CL2 Circuit Block Diagram

6.2 CH4 and CL4

6.2.1 Audio Signal Path

For the sake of simplicity, only channel one of the audio signal path is described.

Signal is presented to the CH4/CL4 through one of three connectors when using the standard input module. Each channel is outfitted with a balanced XLR/phone jack, and a barrier strip. These connectors are wired in parallel, which allows daisy chaining when needed. The signal is then converted from balanced to unbalanced in the Balanced Input Stage where it also receives RFI protection. Signal then flows into the Variable Gain Stage where the front panel level controls are allowed to affect the gain.

Following this stage, the signal goes through a gain stage that allows for the various positions of the sensitivity settings. The signal is then put under the control of a full-time compressor circuit comprised of a symmetrical window detector, a buffer amplifier, and the gating op amp which uses several small components to set the compressor's attack and decay characteristics. The actual compressing is accomplished by an opto-isolator that affects the gain in the signal path.

Next, the signal enters a 32-kHz 7th-Order Gaussian Low-Pass Filter. This filter prevents the modulator stage and the output filter (both described below) from receiving signals that are too high. Without the 32-kHz filter, the modulator would be unable to process signals that are too high and the output filter would not yield the proper frequency response behavior. The Gaussian filter type is unique in that it has minimal ringing and excellent phase response so even a high-order filter such as this one does not adversely affect the sonic excellence of the product.

In the CH4, the signal then travels either through the HP filter module or is bypassed around it depending on the position of the channel operation switch. With the switch set in the 70V position, the filter is enabled. The filter is an 18 dB-per-octave high-pass with a –3-dB rolloff at 70 Hz. This provides a measure of protection to step-down transformers used in distributed speakers installations. With the switch set in the 4/8-Ohm setting, the filter is bypassed. The power is delivered to the load cables through the output connector panel which consists of one of several options.

The signal next enters the main amplifier error amp where it is mixed with a small portion of the output voltage and current in such a way as to control the amplifier's overall output performance.

Following the error amp is the modulator stage where the audio signal is compared to an extremely accurate 250-kHz triangle waveform. Comparators output a

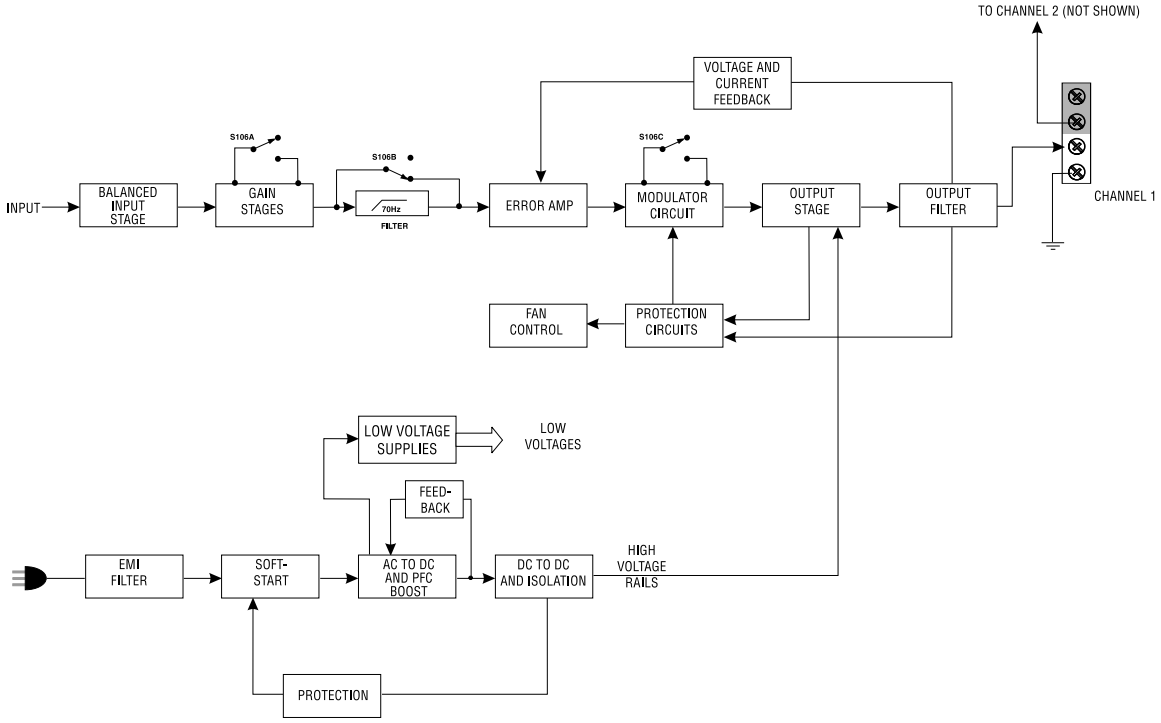


Figure 6.3 CH4 Circuit Block Diagram

Pulse Width Modulated (PWM) string of pulses at 250 kHz that vary in width depending on the level of the input signal. These strings of pulses, one for the positive side and one for the negative side, are connected to the output stage via optocouplers.

The signals from the optos are then passed to gate drivers that amplify the pulses to the level required to drive output devices. The driven output devices are now able to produce PWM pulses that have an output voltage from the negative high-voltage rail (–Vcc) to the positive high-voltage rail (+Vcc). This output voltage is always the same (2 * Vcc) but the width of the pulses is still dependent on the level of the input signal. The positive and negative output PWM pulses then pass through inductors and are summed together. Summing the output signals through inductors reconstructs the audio signal, amplified to the desired level. There is a small amount of ripple on the output that is at double the switching frequency (500 kHz).

The amplified audio signal is then passed through an output filter that removes the residual ripple voltage.

Protection for the output devices is performed by a very precise pulse-by-pulse current limiter circuit that operates each time the output devices switch. The current limiting is “flat” meaning that, regardless of the output voltage, the output current always limits at a certain value.

The turn-on delay circuitry functions to keep the modulators turned off (which keeps the outputs from switching) until all supplies are up and stable.

Thermal probes monitor Heatsink temperatures and power transformer temperature. As the temperatures rise, the probes send a proportional voltage to the fan control circuit and the Thermal Limit Control (TLC) circuit. The fan normally runs at very low speed when the amplifier is idling or when it is being used for low to moderate duty work. If the amplifier is delivering large amounts of power into low impedance loads, the heatsinks or transformer may heat up enough to increase the speed of the fan to medium and possibly to high speed. If the temperature continues to increase, the TLC circuit uses the compressor to reduce the gain of the input stage and thus reduce the power dissipated by the amplifier. As a further protective measure, if the temperature continues to rise (due to blocked airflow for example), the amplifier will stop running and keep the fan on high speed to quickly bring the temperature back to an operational level.

If a signal presented at the input of the amplifier will not be passed through to the output, the Fault LED will blink to get your attention. The turn-on delay, for example, will cause each channel’s LED to blink because the amplifier remains in standby for a few seconds before it allows audio output.

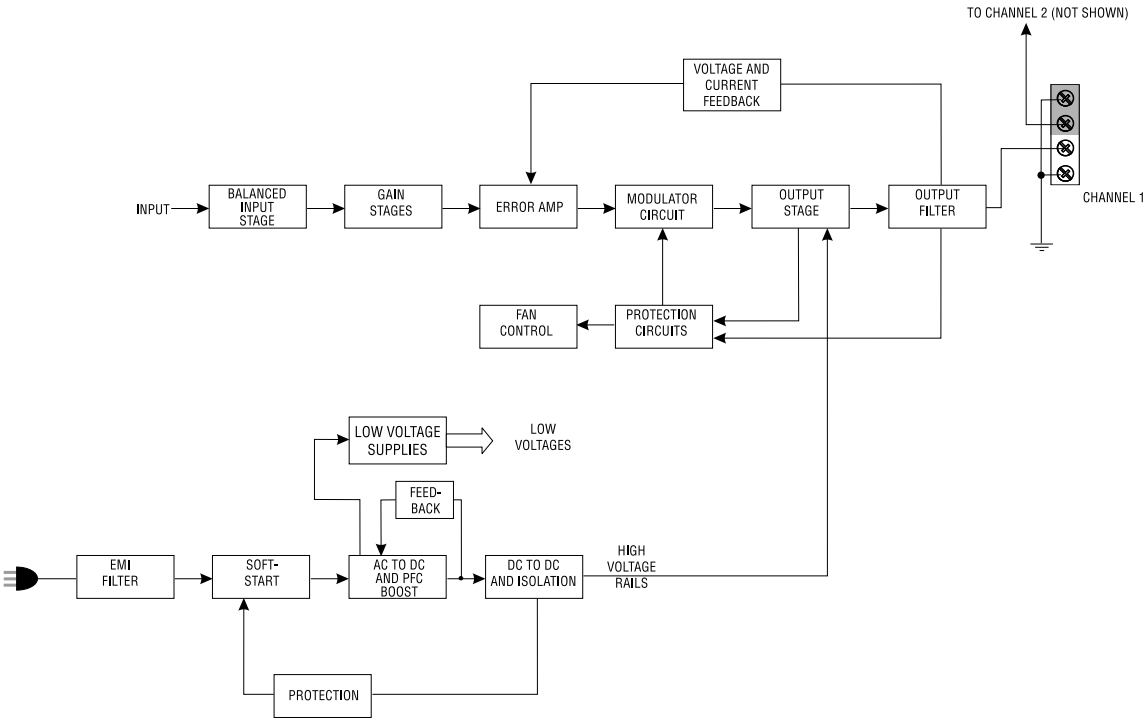


Figure 6.4 CL4 Circuit Block Diagram

An RJ11 modular jack is mounted on the back panel. Pins 2 and 5 are connected to an opto-isolator that is always in a low-resistance state whenever the unit is on and happy. Should a fault be detected or should the amplifier lose AC power, the opto-isolator will change to a high resistance, allowing the user to remotely detect the status of the amplifier.

The Signal Presence Indicators tap the signal chain just before the level controls and prior to the power amplifier chain. They are not amplifier output indicators and should only be used to indicate the presence of signal to the amplifier front end.

The Clip indicators are driven from the output of the compressor circuitry and light to indicate the onset of audible distortion. The Power indicator LED is driven from the low-voltage supply.

6.2.2 Power Supply Operation

AC power enters the amplifier through a power cord equipped with an IEC (unplugable) connector. It then is passed through the EMI filter. Circuits that use switching technology will normally send a small amount of high-frequency noise back down the power cord and into the power distribution system. This noise must be removed in order to sell the unit in certain parts of the world. Since the CH4/CL4 is a worldwide product, the EMI filter removes this noise so that it does not exit the box.

The power then enters the Power Factor Correction (PFC) Boost stage. This stage is what allows the CH4/CL4 to be plugged into any outlet in the world without any modifications to the amplifier. The PFC stage uses switching power supply technology to take whatever AC line voltage comes in, convert it to DC and boost it to 400 Volts. The circuit also uses intelligence to draw the current from the line sinusoidally and in phase with the line voltage. This reduces the load on the power companies and also allows the amplifier to pull more peak power from the power source (the outlet). The power is drawn in small amounts 62,500 times each second and is used to provide power to the isolation stage and to fill the large energy reservoir capacitors.

The power then goes to the “buck” isolation stage. This stage takes the 400 Volt PFC voltage and, again using switching power supply technology, converts it down (“bucks” it down) to the level needed to power the audio output stage. The isolation stage also satisfies a safety requirement by providing isolation, using a transformer, between the AC mains power and the power that is delivered to the speakers. The isolation stage moves power 125,000 times each second from the primary to the secondary to power the audio output stage and keep its large energy reservoir capacitors full.

In order to keep the power supply controllers, protection circuits, and the audio signal path components powered, another switching power supply is used, this one also running at 125 kHz. This one is also a “buck” type supply in that it takes voltage from the 400 Volt PFC bus and converts it down to the low voltages needed. This circuit also uses a transformer to provide safety isolation.

Like the audio signal path parts of the amplifier, there are many ways that the power supply protects itself. Part of the start-up time delay mentioned above occurs while the power supply is ramping up all of its voltages (soft-start) so that large inrush currents are avoided. Current limiters and over-current detectors are used to protect the power supply output devices. The power supply will also detect severe brownouts and shut off the supply until the brown-out is over if the line voltage is drastically less than normal.

7 Specifications

Note: All measurements apply to all models of CH and CL series amplifiers in stereo mode with 8-ohm loads and an input sensitivity of 26-dB gain, 1-kHz at rated power unless other otherwise specified. Specifications for units supplied outside the U.S.A. may vary slightly at different AC voltages and frequencies.

Power

Load Impedance:
Safe with all types of loads.

CH1:
4 and 8 ohm Stereo;
16 ohm at 70V Stereo;
32 ohm at 100V Stereo;
8 and 16 ohm Bridge;
32 ohm at 140V Bridge;
64 ohm at 200V Bridge.

CH2:
4 and 8 ohm Stereo;
8 ohm at 70V Stereo;
16 ohm at 100V Stereo;
8 and 16 ohm Bridge;
16 ohm at 140V Bridge;
32 ohm at 200V Bridge.

CH4:
4 and 8 ohm Stereo;
4 ohm at 70V Stereo;
8 and 16 ohm Bridge;
8 ohm at 140V Bridge.

CL1, CL2 and CL4:
2, 4 and 8 ohm Stereo;
4, 8 and 16 ohm Bridge.

Voltage Gain, 1 kHz, 1.4V sensitivity,

CH1,
30.5 dB (4/8 ohm);
34 dB (70V);
37 dB (100V).

CH2,
32.1 dB (4/8 ohm);
34 dB (70V);
37 dB (100V).

CH4,
34 dB (4/8 ohm);
34 dB (70V).

CL1,
30.5 dB at (4/8 ohm).

CL2,
32.1 dB at (4/8 ohm).

CL4,
34 dB (4/8 ohm).

AC Line Requirements:
Note: North American CH 1, CL 1, CH 2 and CL 2 units are 60 Hz only. All other models are 50/60 Hz. Voltages are ±10%.

AC Line Current,

CH 1 & CL 1:
100 Volts: 7.6 A;
120 Volts: 6.3 A;
230-240 Volts: 3.5 A.

CH 2 & CL 2:
100 Volts: 11.4 A;
120 Volts: 9.5 A;
230-240 Volts: 5.0 A.

CH 4 & CL 4:
100 Volts: 8.5 A;
120 Volts: 7.1 A;
230-240 Volts: 3.7 A.

AC Line Connector: Detachable 15A IEC connector with country-specific plug.

Output Power:
(See Figure 7.1).

Performance

Frequency Response, 20 Hz to 20 kHz at 1 watt,
CH 1, CH 2, CL 1 & CL 2: ±0.1 dB (see Figures 7.2 and 7.3).
CH 4 & CL 4: ±0.25 dB (see Figure 7.4).

Phase Response: ±15 degrees from 20 Hz to 20 kHz at 1 watt.

Signal to Noise Ratio, A-Weighted,
CH 1, CH 2, CL 1 & CL 2: Better than 105 dB below rated 1-kHz power.
CH 4 & CL 4: Better than 102 dB below rated 1-kHz power.

Total Harmonic Distortion (THD), 1 kHz at rated power: 0.5% or less true THD from 20 Hz to 20 kHz.

Intermodulation Distortion (60 Hz and 7 kHz at 4:1): Less than 0.1% at rated power to 30 dB below rated power at 8 ohms.

Damping Factor (8 ohm),
CH 1, CH 2, CL 1 & CL 2: Better than 400 from 10 Hz to 400 Hz (see Figure 7.5).

CH 4 & CL 4: Better than 700 from 10 Hz to 400 Hz (see Figure 7.6).

Crosstalk, 20 Hz to 20 kHz: Better than 50 dB below rated power.

Common Mode Rejection (CMR): Better than 70 dB from 20 Hz to 1 kHz.

DC Output Offset (Shorted Input): ±10 mV.

Controls

Level: A detented rotary level control for each channel located on the rear panel.

Power: An on/off rocker switch located on the front panel.

Mode: A two-position switch located on the back panel which, when turned to "Stereo," operates the amplifier as two independent channels. When "Bridge" is selected, the amplifier bridges the two output channels for twice the output voltage.

Channel Operation Switch (CH Series only): A two-position switch located on the back panel which, when turned to 4/8 Ohm, sets the amplifier to drive low-impedance speaker loads. Turning the switch to 70V/100V (70V only on the CH4) sets the amplifier to drive distributed high-impedance speaker loads and inserts a 70-Hz high-pass filter into the signal chain to prevent step-down transformer saturation (see Section 4.4).

Indicators

Signal: A green indicator for each channel which flashes when a very low-level signal (>-40 dBm) is present at input. May be used for troubleshooting cable runs.

Clip: A red indicator for each channel which turns on when distortion becomes audible in the amplifier output.

Fault: A red indicator for each channel which indicates amplifier has muted output. Normally off. Status may be monitored remotely by plugging into back-panel RJ11 Fault jack.

Power: A blue indicator that turns on when the amplifier has been turned on and has power.

Input/Output

Input Connector (standard module): One Neutrik Combo connector for each channel which features a balanced ¼-inch (6.35-mm) phone jack and a 3-pin female XLR connector, in parallel with a barrier strip termination.

Input Stage: Input is electronically balanced and employs precision 1% resistors.

Input Impedance: Nominally 20 k ohms, balanced. Nominally 10 k ohms, unbalanced.

Input Sensitivity: Channel independent. Factory set at 1.4 volts for standard 1-kHz, 8-ohm power. 26-dB gain and 0.775-volt sensitivity available as a Service Option.

Output Impedance: See Figures 7.7 and 7.8.

Output Connectors,
CH1 and CH2: Four-terminal touch-proof barrier block, one per channel, allows connection of load to 8-ohm, 4-ohm, 70V or 100V outputs.
CH4: Four-terminal touch-proof barrier block.
CL Series: Four-terminal touch-proof barrier block.

Output Signal,
Stereo: Unbalanced, two-channel.
Bridge-Mono: Balanced, single-channel. Channel 1 controls are active; Channel 2 should be turned down.

Protection

CH and CL Series amplifiers are protected against shorted, open or mismatched loads; overloaded power supplies; excessive temperature, chain destruction phenomena, input overload damage and high-frequency blowups. They also protect loudspeakers from input/output DC, large or dangerous DC offsets and turn-on/turn-off transients.

Options

Service Options: SST-SBSC: variable Linkwitz-Riley stereo crossover with mono-summed sub-bass outputs; SST-MX: 100-Hz Linkwitz-Riley crossover with stereo sub-bass output; SST-SX: 80-/120-Hz switchable Linkwitz-Riley crossover with mono summed sub-bass output.

Construction

Rugged steel chassis is formed into a durable package, then coated with environmentally friendly powder for long life and ease of maintenance.

Cooling: Proportional speed fan.

Dimensions,
Width (all models): EIA Standard 19-inch rack mount (EIA RS-310-B);

Height (all models): 5.25-inch (13.34-cm);

Depth (behind front mounting surface),
CH 1, CH 2, CL 1 and CL 2: 12.25-inch (31.11-cm);
CH 4 and CL 4: 16.25-inch (36.56-cm).

Weight,
CH 1: 40.6 pounds (18.4 kg);
CH 2: 48.3 pounds (21.9 kg);
CL 1: 32.6 pounds (14.78 kg);
CL 2: 40.3 pounds (18.28 kg);
CH 4 and CL 4: 33.3 pounds (15.1 kg).

For shipping weight, add 6 pounds (2.7 kg) to each amp.

Output Power

Output Power at 1 kHz at rated THD; Stereo mode, per channel with both channels driven.

	STEREO MODE					BRIDGE MODE			
	2 Ohms	4 Ohms	8 Ohms	70V	100V	4 Ohms	8 Ohms	140V	200V
CH1		450W	275W	300W	300W		900W	600W	600W
CH2		660W	400W	600W	600W		1320W	1200W	1200W
CH4		1200W	600W	1200W			2400W	2400W	
CL1	560W	450W	275W			1100W	900W		
CL2	975W	660W	400W			1950W	1320W		
CL4	1800W*	1200W	600W			3600W*	2400W		

* ≥ 200VAC Line Voltage

Figure 7.1 Contractor Series Output Power

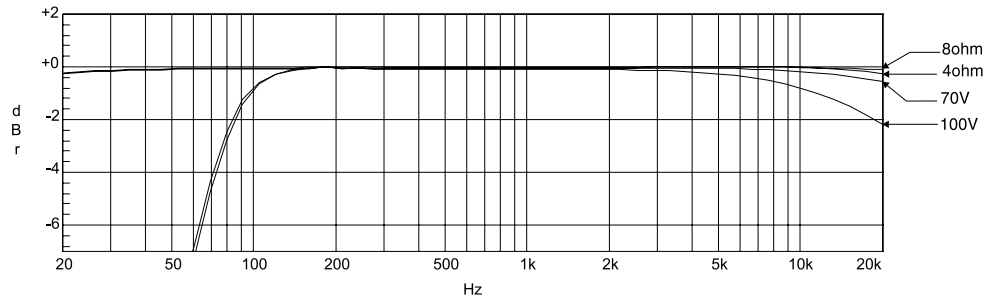


Figure 7.2 CH1 & CH2 Frequency Response

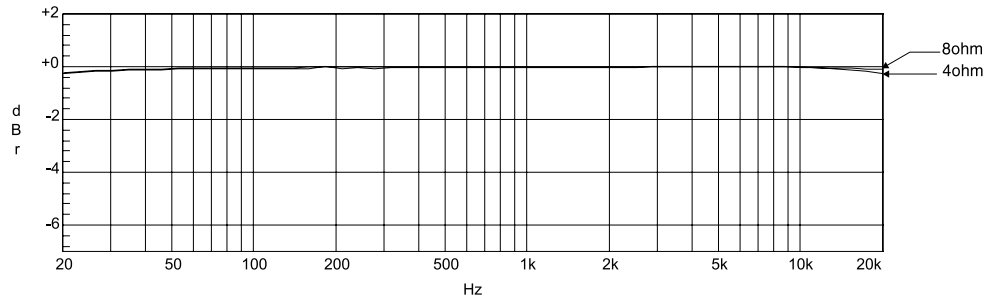


Figure 7.3 CL1 & CL2 Frequency Response

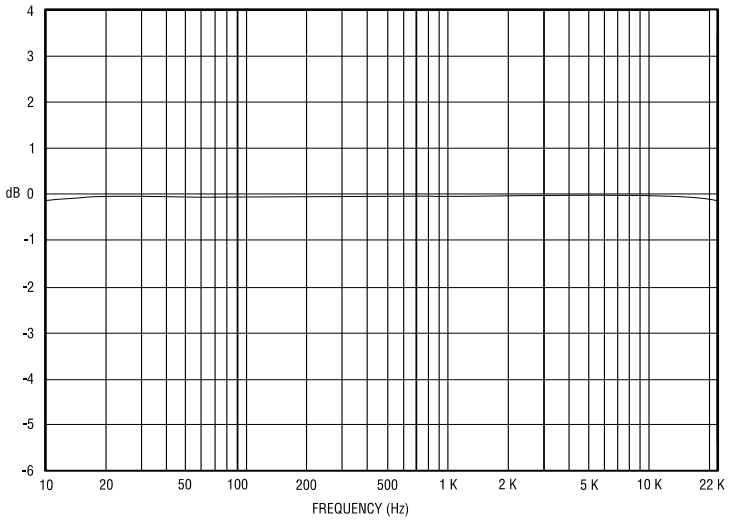


Figure 7.4 CH4 & CL4 Frequency Response

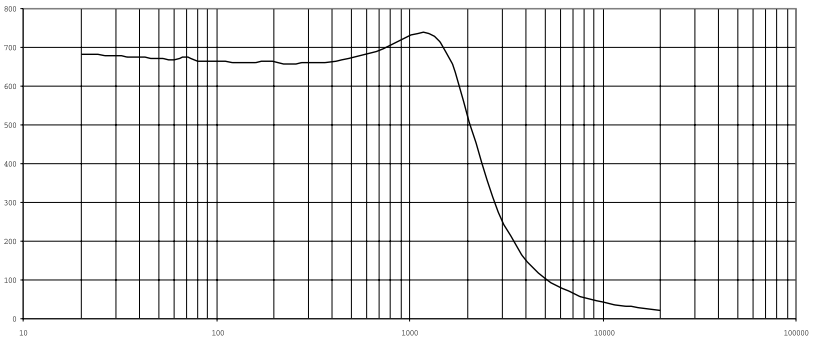


Figure 7.5 CH1, CH2, CL1 & CL2 Damping Factor

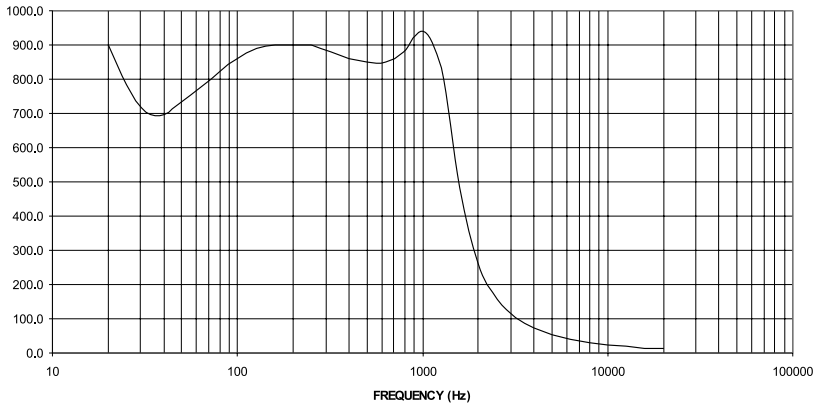


Figure 7.6 CH4 & CL4 Damping Factor

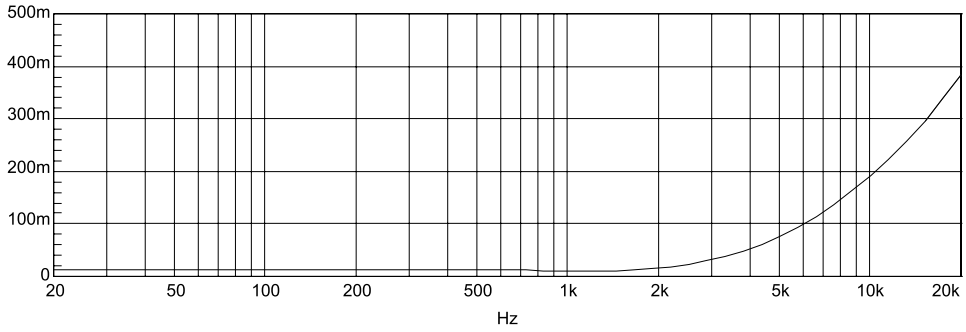


Figure 7.7 CH1, CH2, CL1 & CL2 Output Impedance

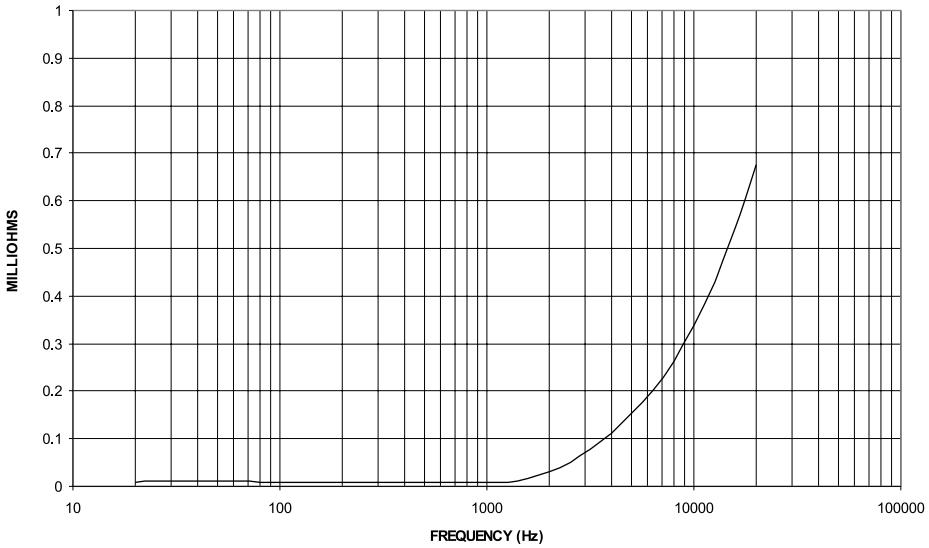


Figure 7.8 CH4 & CL4 Output Impedance

8 AC Power Draw and Thermal Dissipation

This section provides detailed information about the amount of power and current drawn from the AC mains by Contractor Series amplifiers and the amount of heat produced under various conditions. The calculations presented here are intended to provide a realistic and reliable depiction of the amplifiers. The following assumptions or approximations were made:

- The amplifier's available channels are loaded, and full power is being delivered.
- Amplifier efficiency at standard 1-kHz power is estimated to be 65% for CH1, CH2, CL1 and CL2 models, and 77% for CH4 and CL4 models.
- Typical quiescent power draw is approximately 60 watts for CH1, CH2, CL1 and CL2 models, and 140 watts for CH4 and CL4 models.
- When running at full speed, typical power draw for the internal fan is 12 watts for all models.
- Quiescent thermal dissipation is related .
- The estimated duty cycles take into account the typical crest factor for each type of source material.
- Duty cycle of pink noise is 50%.
- Duty cycle of highly compressed rock 'n' roll midrange is 40%.
- Duty cycle of rock 'n' roll is 30%.
- Duty cycle of background music is 20%.
- Duty cycle of continuous speech is 10%.
- Duty cycle of infrequent paging is 1%.

Here are the equations used to calculate the data presented in Figures 8.1 through 8.6:

$$\text{AC Mains Power Draw (watts)} = \frac{\text{Total output power with all channels driven (watts)} \times \text{Duty Cycle}}{\text{Amplifier Efficiency}} + \text{Quiescent and Fan Power Draw (watts)}$$

The value used for Amplifier Efficiency is 0.65 for CH1, CH2, CL1 and CL2 models, and 0.77 for CH4 and CL4 models. (these values are listed in the previous column).

The following equation converts power draw in watts to current draw in amperes:

$$\text{Current Draw (amperes)} = \frac{\text{AC Mains Power Draw (watts)}}{\text{AC Mains Voltage} \times \text{Power Factor}}$$

The value used for Power Factor is 0.83 for CH1, CH2, CL1 and CL2 models, and 0.98 for CH4 and CL4 models. The Power Factor variable is needed to compensate for the difference in phase between the AC mains voltage and current.

The following equation is used to calculate thermal dissipation.

$$\text{Thermal Dissipation (btu/hr)} = \left(\frac{\text{Total output power with all channels driven (watts)} \times \text{Duty Cycle} \times \text{Amplifier Inefficiency}}{\text{Amplifier Efficiency}} + \text{Quiescent and Fan Power Draw (watts)} \right) \times 3.415$$

The value used for Amplifier Inefficiency is 0.35 (1.00–0.65) for CH1, CH2, CL1 and CL2 models, and 0.23 (1.00–0.77) for CH4 and CL4 models.The factor 3.415 converts watts to btu/hr. Thermal dissipation in btu is divided by the constant 3.968 to get kcal.

If you plan to measure output power under real-world conditions, the following equation may also be helpful:

$$\text{Thermal Dissipation (btu/hr)} = \left(\frac{\text{Total measured output power from all channels (watts)} \times \text{Amplifier Inefficiency}}{\text{Amplifier Efficiency}} + \text{Quiescent and Fan Power Draw (watts)} \right) \times 3.415$$

CH1

	LOAD														
	4Ω DUAL / 8Ω BRIDGE					8Ω DUAL / 16Ω BRIDGE					70V,100V DUAL 300W / 140V, 200V BRIDGE 600W				
Duty Cycle	AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation	
		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr
50%	752	7.6	3.8	1032	260	483	4.8	2.4	710	179	522	5.2	2.6	757	191
40%	614	6.2	3.1	867	218	398	4.0	2.0	609	153	429	4.3	2.2	646	163
30%	475	4.8	2.4	701	177	314	3.2	1.6	508	128	337	3.4	1.7	536	135
20%	337	3.4	1.7	532	135	230	2.3	1.2	407	103	245	2.5	1.3	426	107
10%	198	2.0	1.0	370	93	145	1.5	.8	306	77	152	1.5	.8	315	79

Figure 8.1 CH1 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

CH2

Duty Cycle	LOAD														
	4Ω DUAL / 8Ω BRIDGE					8Ω DUAL / 16Ω BRIDGE					70V,100V DUAL 600W / 140V, 200V BRIDGE 1200W				
	AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation	
		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr
50%	1075	10.8	5.4	1419	296	675	6.7	3.4	940	237	983	9.8	4.9	1308	330
40%	872	8.8	4.4	1175	260	552	5.5	2.8	793	200	798	8.0	4.0	1088	274
30%	669	6.7	3.4	993	235	429	4.3	2.2	646	163	614	6.1	3.1	867	218
20%	466	4.7	2.4	690	174	306	3.1	1.6	499	126	429	4.3	2.2	646	163
10%	263	2.6	1.3	448	113	183	1.8	1.4	352	89	245	2.5	1.3	426	107

Figure 8.2 CH2 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

CH4

Duty Cycle	LOAD														
	4Ω DUAL / 8Ω BRIDGE					8Ω DUAL / 16Ω BRIDGE					70V DUAL 600W / 140V BRIDGE 1200W				
	AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation	
		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr
50%	1698	14.4	7.2	1702	429	919	7.8	3.9	1090	275	1698	14.4	7.2	1702	429
40%	1387	11.8	5.9	1457	367	763	6.5	3.3	968	244	1387	11.8	5.9	1457	367
30%	1075	9.1	4.6	1213	306	608	5.2	2.6	845	231	1075	9.1	4.6	1213	306
20%	796	6.5	3.3	968	244	452	3.8	1.9	723	182	796	6.5	3.3	968	244
10%	452	3.8	1.9	723	182	296	2.5	1.3	601	151	452	3.8	1.9	723	182

Figure 8.3 CH4 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

CL1

Duty Cycle	LOAD														
	2Ω DUAL / 4Ω BRIDGE					4Ω DUAL / 8Ω BRIDGE					8Ω DUAL / 16Ω BRIDGE				
	AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation	
		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr
50%	906	9.1	4.6	1216	306	752	7.6	3.8	1032	260	483	4.8	2.4	710	179
40%	737	7.4	3.7	1014	256	614	6.2	3.1	867	218	398	4.0	2.0	609	153
30%	568	5.7	2.9	812	205	475	4.8	2.4	701	177	314	3.2	1.6	508	128
20%	398	4.0	2.0	609	153	337	3.4	1.7	532	135	230	2.3	1.2	407	103
10%	229	2.3	1.2	407	103	198	2.0	1.0	370	93	145	1.5	.8	306	77

Figure 8.4 CL1 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

CL2

	LOAD														
	2Ω DUAL / 8Ω BRIDGE					4Ω DUAL / 8Ω BRIDGE					8Ω DUAL / 16Ω BRIDGE				
Duty Cycle	AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation	
		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr
50%	1560	15.6	7.8	1998	504	1075	10.8	5.4	1419	296	675	6.7	3.4	940	237
40%	1260	12.6	6.3	1639	413	872	8.8	4.4	1175	260	552	5.5	2.8	793	200
30%	960	9.6	4.8	1281	323	669	6.7	3.4	993	235	429	4.3	2.2	646	163
20%	660	6.6	3.3	922	232	466	4.7	2.4	690	174	306	3.1	1.6	499	126
10%	360	3.6	1.8	563	142	263	2.6	1.3	448	113	183	1.8	1.4	352	89

Figure 8.5 CL2 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

CL4

	LOAD														
	2Ω DUAL / 8Ω BRIDGE					4Ω DUAL / 8Ω BRIDGE					8Ω DUAL / 16Ω BRIDGE				
Duty Cycle	AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation		AC Mains Power Draw (Watts)	Current Draw(Amps)		Thermal Dissipation	
		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr		100-120	230-240	btu/hr	kcal/hr
50%	2478	21.1	10.6	2314	583	1698	14.4	7.2	1702	429	919	7.8	3.9	1090	275
40%	2010	17.1	8.6	1947	491	1387	11.8	5.9	1457	367	763	6.5	3.3	968	244
30%	1542	13.1	6.6	1580	398	1075	9.1	4.6	1213	306	608	5.2	2.6	845	231
20%	1075	9.1	4.6	1213	306	796	6.5	3.3	968	244	452	3.8	1.9	723	182
10%	607	5.2	2.6	845	213	452	3.8	1.9	723	182	296	2.5	1.3	601	151

Figure 8.6 CL4 Power Draw, Current Draw and Thermal Dissipation at Various Duty Cycles

9 Installation Helps

9.1 Cooling

It is important to understand cooling considerations when installing a Contractor Series amplifier. Proper cooling of your amplifier will ensure efficient uninterrupted operation even under varying conditions.

First, never block the amplifier's front or rear air vents. This can cause poor air flow and may result in overheating. Many things can cause air flow restrictions, including improper mounting, bunched up power cords, closed rack doors, and clogged intakes and/or exaust vents. A Contractor Series amplifier should be mounted in a way that allows sufficient air flow into the front intakes, out the rear exhaust vents, and out the back of the rack. Open spaces in the front of the rack should be covered with blank panels to prevent heated air from the rear exhaust vents from being drawn into the front air intake which may greatly reduce the cooling system's effectiveness.

The air flow requirement for a Contractor Series amplifier depends on many things, but the most important factor is average output power. Air flow requirements increase as output power increases, so anything that affects output power also affects the required air flow.

Average output power is mainly affected by three things: (1) duty cycle of the input signal, (2) load impedance, and (3) rated output power. First, as the duty cycle of the input signal increases, the average output power level increases. For example, the amplifier will need more air flow with a rock 'n' roll input signal than with infrequent paging. Second, as the load impedance of a connected loudspeaker gets smaller, more current will flow through the load which effectively increases output power. This means you can expect the amplifier to require more air flow with a 2-ohm load than with an 8-ohm load. Finally, an amplifier that is rated for higher power output is usually used at higher average output levels. So for example, a CL2 delivering full output will require more air flow than a CL1.

9.1.1 Additional Cooling

If multiple amplifiers will be operated under demanding conditions (such as driving loads less than 4 ohms), or if air flow through the rack will be restricted, you should verify that the total air flow through the rack will be sufficient. Cooling can be improved by reducing air restrictions, installing a rack-mounted blower, or using an air conditioner.

If your rack has a front door, it is usually best to leave it open and avoid blocking the air intakes. If this is impossible, supplement the air flow by mounting a grille in the door or using a rack-mounted blower. If you install a grille in the door, we recommend wire grilles instead of perforated panels, because wire tends to cause less air restriction (perforated panels cause a minimum air restriction of 40%). If rack will be located in a dusty or dirty environment, it is advisable to pre-filter the air using industrial furnace filters. These filters can be taped or fastened to the front of the equipment rack, ensuring a clean air supply through a large surface area that will require minimum maintenance.

A better choice for increasing the air flow behind a rack cabinet door is to use a "squirrel cage" blower. Mount the blower at the bottom of the rack so it blows outside air into the space between the door and the front of the amplifiers, pressurizing the "chimney" behind the door (Figure 9.1, Option 1). The blower should not blow air into or take air out of the space behind the amplifiers. For racks without a front door, you can evacuate the rack by mounting the blower at the top of the rack so that air blows out the back (Figure 9.1, Option 2).

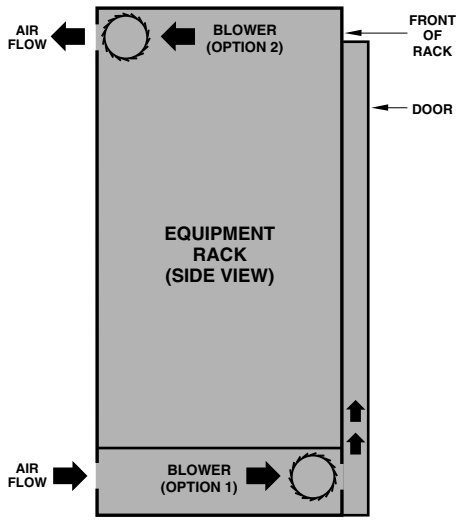


Figure 9.1 Extra Cooling with a Rack-Mounted Blower

9.2 Input Wiring

A balanced audio circuit typically will have both positive (+) and negative (–) legs of the circuit isolated from the ground circuit. These balanced legs exhibit identical impedance characteristics with respect to ground, and may also carry the audio signal at the same level, but with opposite polarities. This results in a line that offers excellent rejection of unwanted noise.

On the other hand, an unbalanced circuit usually holds

one leg at ground potential, while the second leg is "hot." Unbalanced line is less expensive, but is much more susceptible to noise, and is not usually used in professional applications. For the cleanest signal, without unwanted hum and buzz, balanced line is always recommended. It is especially helpful if you have a long cable run (over 10 feet (3 m)), since noise is easily introduced into long, unbalanced lines.

Figure 9.2 shows pin assignments for balanced and unbalanced XLR and TRS connectors. Figure 9.3 shows polarity conversions for both connector types.

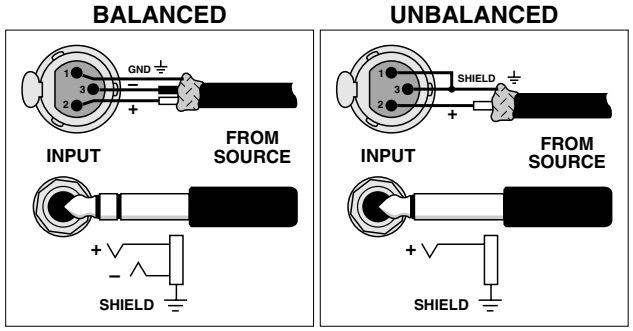


Figure 9.2 Balanced & Unbalanced Input Wiring

	1/4 inch (6.35 mm)	XLR
+ =	Tip =	Pin 2
— =	Ring =	Pin 3
⏚ =	Sleeve =	Pin 1

Figure 9.3 Polarity Conversions

Proper input wiring depends on two factors: (1) whether the input signals are balanced or unbalanced, and (2) whether the signal source floats or has a ground reference. The illustrations in Figures 9.4 and 9.5 provide examples of recommended connection techniques for each type of signal source.

9.2.1 Solving Input Problems

Sometimes large **infrasonic** (sub-audible) **frequencies** are present in the input signal. These can damage loudspeakers or step-down transformers by overloading or overheating them. In CH Series ampifiers, such frequencies are attenuated by the 24-dB-per-octave 70-Hz high-pass filter when operated in 70V or 100V mode. To attenuate such frequencies when using CH Series amplifiers in 4/8 ohm mode, or CL Series amplifiers, place a capacitor in series with the input signal line. The graph in Figure 9.6 shows some capacitor values and how they affect frequency response. Use only low-leakage capacitors.

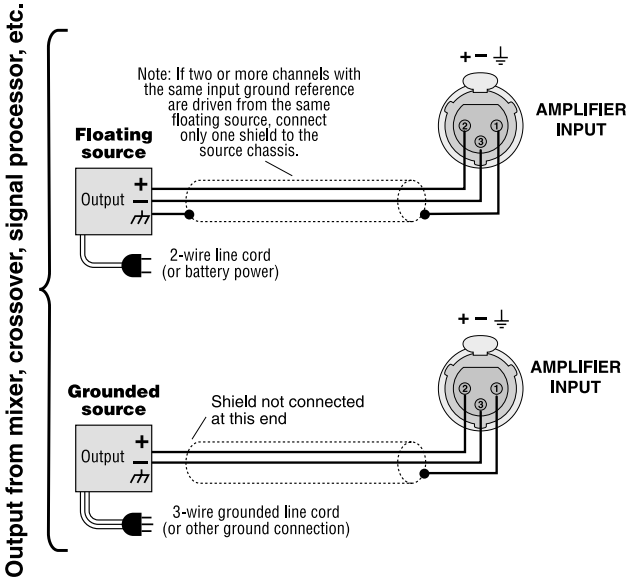

Output from mixer, crossover, signal processor, etc.
Note: If two or more channels with the same input ground reference are driven from the same floating source, connect only one shield to the source chassis.
Floating source
Output
2-wire line cord (or battery power)
AMPLIFIER INPUT
Grounded source
Shield not connected at this end
3-wire grounded line cord (or other ground connection)

Figure 9.4 Balanced Input Wiring

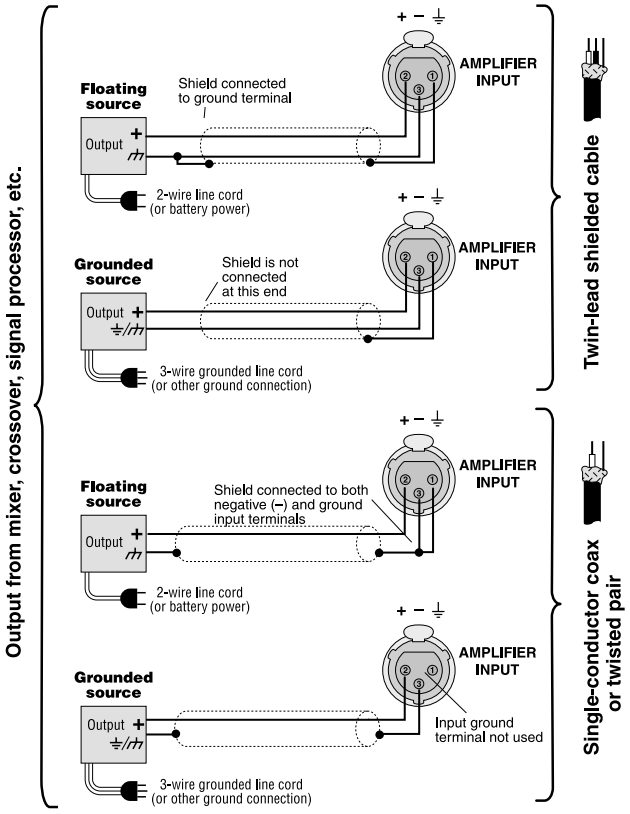

Output from mixer, crossover, signal processor, etc.
Floating source
Shield connected to ground terminal
Output
2-wire line cord (or battery power)
AMPLIFIER INPUT
Grounded source
Shield is not connected at this end
3-wire grounded line cord (or other ground connection)
Twin-lead shielded cable
Shield connected to both negative (–) and ground input terminals
Input ground terminal not used
Single-conductor coax or twisted pair

Figure 9.5 Unbalanced Input Wiring

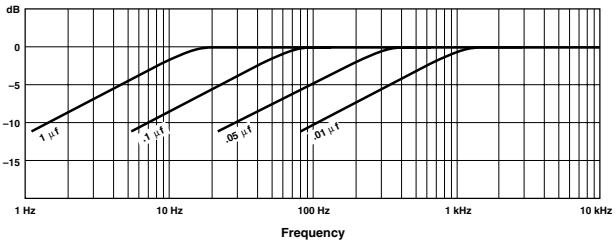


Figure 9.6 Infrasonic Filter Capacitor Values

Sometimes large levels of **radio frequencies** or RF are present in the input signal. Although high RF levels may not pose a threat to the amplifier, they can burn out tweeters or other loads that are sensitive to high frequencies. Extremely high RF levels can also cause your amplifier to prematurely activate its protection circuitry, resulting in inefficient operation. RF can be introduced into a signal by local radio stations and from the bias signal of many tape recorders. To prevent high levels of input RF, install an appropriate low-pass filter in series with the input signal. Some examples of unbalanced wiring for low-pass filters are shown in Figure 9.7.

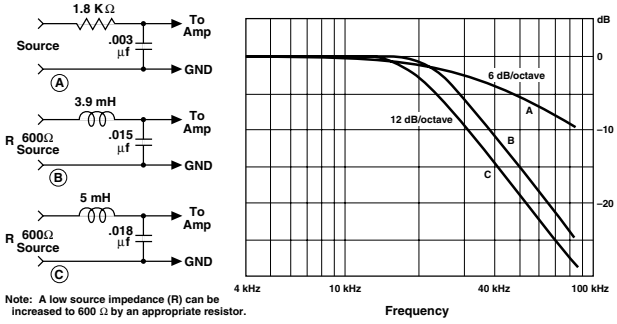


Figure 9.7 Unbalanced RFI Filters

For balanced input wiring, use an example from Figure 9.8. Filters A, B, and C correspond to the unbalanced filters A, B, and C shown in Figure 9.7.

Another problem to avoid is **hum**. The two most common sources of hum in an audio system are **inductive coupling** and **ground loops**.

Inductive coupling can occur when input cables are subjected to a magnetic field from a power cord or power transformer. One way to prevent inductive coupling is to lace the input cables together along their length and route them as far away as possible from power transformers and power cords. The use of shielded pair cable is another effective way to reduce or eliminate hum resulting from inductive coupling.

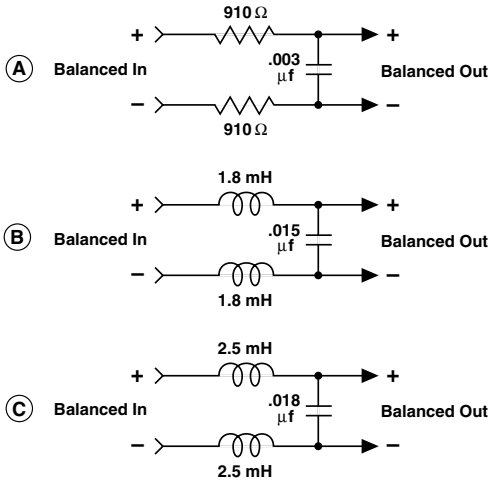


Figure 9.8 Balanced RFI Filters

Ground loops often result when two or more devices are improperly grounded. This causes undesirable stray currents that may produce hum in the output. The best way to avoid ground loops is to ensure that all system devices are plugged into the same power strip. In addition, make sure that all cable shields are grounded at one end only.

Input and output grounds are sometimes tied together for testing or metering. This can cause **feedback oscillation** from load current in the test loop. In some systems, even the AC power line may provide this feedback path. To avoid this problem, use proper grounding, isolate the inputs and other common AC devices.

9.3 More About Output Modes

9.3.1 4/8 ohm Operation (CH and CL Series)

4/8 ohm operation is commonly used to drive loudspeakers with impedances from 2 to 16 ohms. When using 4/8 ohm operation, appropriate load impedances will depend on the Stereo/Bridge mode you select, as well as the model of Contractor Series amplifier used. CH Series models are rated to drive loads from 4 to 8 ohms in Stereo mode, and from 8 to 16 ohms in Bridge mode. CL Series models are rated to drive loads from 2 to 8 ohms in Stereo mode, and from 4 to 16 ohms in Bridge mode.

9.3.2 70V and 100V Operation (CH Series Only)

70V and 100V output operation is used to drive constant voltage lines without external step-up transformers.

When connecting a step-down transformer, do not exceed its power rating. Too much power can saturate a transformer and cause it to appear as a short circuit to the amplifier. If this happens, no damage should occur, but the amplifier may run less efficiently, and the sound quality may be affected.

If Bridge mode and 70V or 100V Operation are used together, twice the normal output voltage is produced from a single channel to drive distributed loudspeaker systems. If you will be using Bridge mode for 140-volt or 200-volt output, you may need to cross-reference the ratings of the step-down transformer taps with Crown's constant voltage computer (see Section 5.6).

WARNING: Both channels must be configured for the same output operation (4/8 ohm or 70V/100V) before switching to Bridge mode. Never change switch positions with power turned on.

9.4. Output Wiring

You should always install loudspeaker cables of sufficient gauge (wire thickness) for the length used. The resistance introduced by inadequate output cables will reduce the amplifier's power to and motion control of the loudspeakers. The latter problem occurs because the damping factor decreases as the cable resistance increases. This is very important because the amplifier's excellent damping factor can be easily negated by using insufficient cable.

Use the nomograph in Figure 9.9 and the following procedure to find the recommended wire gauge (AWG or American Wire Gauge) for your system.

1. Note the load resistance of the loudspeakers connected to each channel of the amplifier. If you are using 70V or 100V output, be sure to determine the load resistance of the step-down transformers (Crown's constant voltage computer can help with this, see Section 5.5). Mark this value on the **Load Resistance** line of the nomograph.
2. Select an acceptable damping factor and mark it on the **Damping Factor** line. Your amplifier can provide an excellent damping factor of 400 from 10 to 400 Hz in Stereo mode with an 8-ohm load. Higher damping factors yield lower distortion and greater motion control over the loudspeakers. A common damping factor for commercial applications is between 50 and 100. Higher damping factors may be desirable for live sound, but long cable lengths often limit the highest damping factor that can be achieved practically.
3. Draw a line through the two points with a pencil, and continue until it intersects the **Source Resistance** line.
4. On the **2-Cond. Cable** line, mark the length of the cable run.

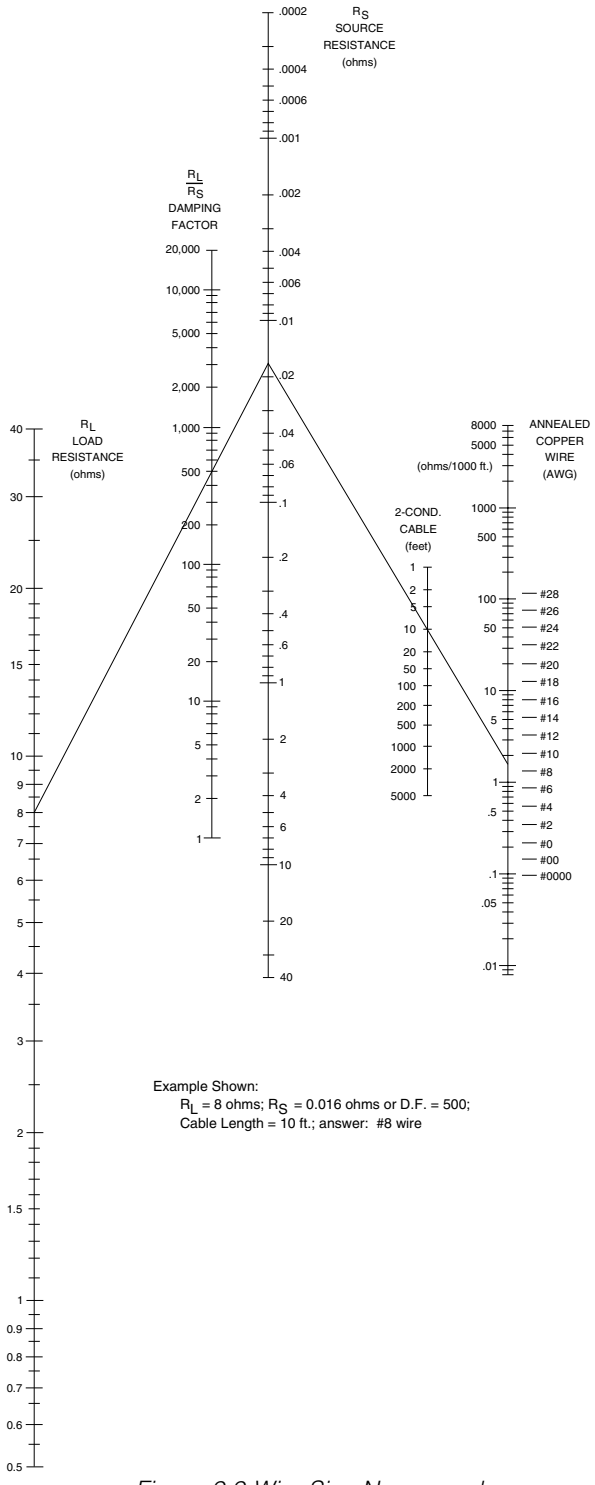

R_S SOURCE RESISTANCE (ohms)
$\frac{R_L}{R_S}$ DAMPING FACTOR
R_L LOAD RESISTANCE (ohms)
2-COND. CABLE (feet)
ANNEALED COPPER WIRE (AWG)
(ohms/1000 ft.)
Example Shown:
R_L = 8 ohms; R_S = 0.016 ohms or D.F. = 500;
Cable Length = 10 ft.; answer: #8 wire

Figure 9.9 Wire Size Nomograph

5. Draw a pencil line from the mark on the **Source Resistance** line through the mark on the **2-Cond. Cable** line, and on to intersect the **Annealed Copper Wire** line.
6. The required wire gauge for the selected wire length and damping factor is the value on the **Annealed Copper Wire**

line. Note: Wire size increases as the AWG gets smaller.

7. If the size of the cable exceeds what you want to use, (1) find a way to use shorter cables, (2) settle for a lower damping factor, or (3) use more than one cable for each line. Options 1 and 2 will require the substitution of new values for cable length or damping factor in the nomograph. For option 3, estimate the effective wire gauge by subtracting 3 from the apparent wire gauge every time the number of conductors of equal gauge is doubled. So, if #10 wire is too large, two #13 wires can be substituted, or four #16 wires can be used for the same effect.

9.4.1 Solving Output Problems

High-frequency oscillations can cause your amplifier to prematurely activate its protection circuitry. The effects of this problem are similar to the RF problems described in Section 9.2.1. To prevent high-frequency oscillations:

1. Bundle together each pair of loudspeaker conductors when using long cable runs or when different amplifiers use a common cable tray or jacket. (Do NOT bundle wires from different amplifiers.) This reduces the chance of conductors acting like antennas to transmit or receive the high frequencies that can cause oscillation.
2. Avoid using shielded loudspeaker cable.
3. Never tie together input and output grounds.
4. Never tie together the output of different amplifiers.
5. Keep output cables separated from input cables.
6. Install a low-pass filter in series with each input (see Section 9.3.1).
7. Install the input wiring according to the instructions in Section 9.2.

Another problem to avoid is the presence of large **infrasonic (sub-audible) currents** when primarily inductive loads are used. Examples of inductive loads are 70-volt transformers and electrostatic loudspeakers.

Inductive loads can appear as a short circuit at low frequencies. This can cause the amplifier to produce large low-frequency currents and activate its protection circuitry. CH Series amplifier have a third-order (18-dB-per-octave) 70-Hz high-pass filter that is which is automatically inserted into the signal path at the input when in 70V or 100V mode. If driving an inductive load, either with a CH Series amplifier in 4/8 ohm mode or with a CL Series amplifier, always take the precaution of installing a high-pass filter in series with the amplifier's input. An 18-dB-per-octave filter between 50 and 70 Hz is recommended.

Another way to protect inductive loads from large low-frequency currents and prevent the amplifier from prematurely activating its protective systems is to parallel a 590 to 708 µF nonpolarized motor start capacitor and a 4-ohm, 20-watt resistor in series with the amplifier output and the positive (+) transformer lead. This circuit is shown in Figure 8.10. It uses components that are available from most electrical supply stores.

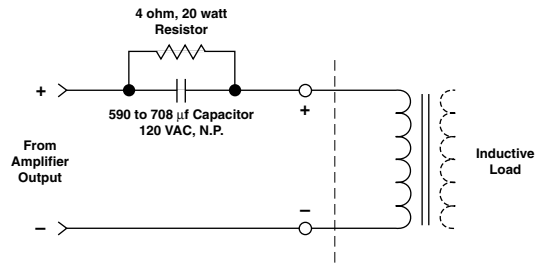


Figure 9.10 Inductive Load (Transformer) Network

9.4.2 Additional Load Protection

Contractor Series amplifiers can generate enormous power output. Using 4/8 ohm output, if your loudspeakers do not have built-in protection from excessive power, it's a good idea to protect them. Loudspeakers are subject to thermal damage from sustained overpowering and mechanical damage from large transient voltages. In both cases, special fuses may be used to protect your loudspeakers, or you may opt to use an outboard limiter to provide loudspeaker protection.

Two different types of fuses are required for thermal protection and voltage protection. Slow-blow fuses are usually selected to protect loudspeakers from thermal damage because they are similar to loudspeakers in the way they respond to thermal conditions over time. In contrast, high-speed instrument fuses like the Littelfuse 361100 series are used to protect loudspeakers from large transient voltages. The nomograph in Figure 9.11 can be used to select the properly rated fuse for either type of loudspeaker protection.

There are mainly two different approaches used when installing fuses for loudspeaker protection. A common practice is to put a single fuse in series with the output of each channel. This makes installation easy because there is only one fuse per channel to install, but it can also lead to problems. The biggest disadvantage becomes apparent if the fuse blows because power to all connected loads will be removed.

A better approach is to fuse each driver independently. This allows you to apply the most appropriate protection for the type of driver being used. In general, low-frequency drivers (woofers) are most susceptible to thermal damage and high-frequency drivers (tweeters)

are usually damaged by large transient voltages. This means that your loudspeakers will tend to have better protection when the woofers are protected by slow-blow fuses and high-frequency drivers are protected by high-speed instrument fuses.

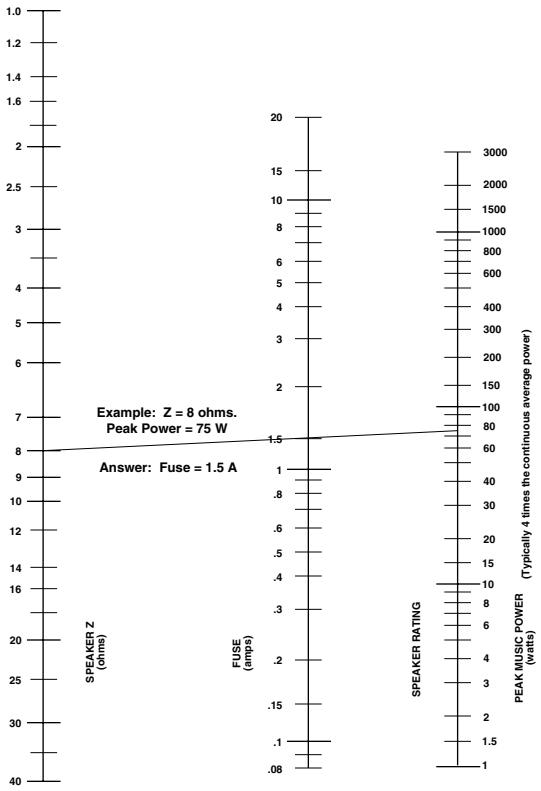

Example: Z = 8 ohms.
Peak Power = 75 W
Answer: Fuse = 1.5 A
SPEAKER Z (ohms)
FUSE (amps)
SPEAKER RATING
PEAK MUSIC POWER (watts)
(Typically 4 times the continuous average power)

Figure 9.11 Loudspeaker Fuse Nomograph

9.5 Fault Circuit Wiring

To set up a circuit that will cause an LED to light whenever a fault status occurs, you can simply use the suggested circuit shown in Figure 9.12.

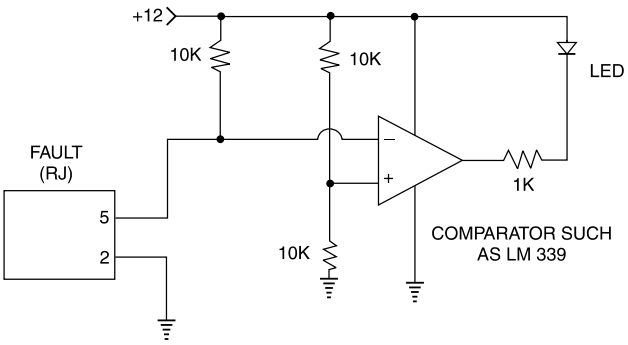


Figure 9.12 Fault Status LED Circuitry

When using this circuit, the LED will glow whenever the amplifier is in one of four states: a channel's heatsink has reached its temperature limit, the transformer has reached its temperature limit, the amplifier has just been turned on and is in its turn-on-delay mode, or the amplifier is turned off.

If you choose to design your own circuit to interface this signal to your system, note that this RJ jack is polarity-sensitive. Pin 2 must be grounded, and Pin 5 must be supplied with a positive voltage pull up (positive with respect to ground). Refer to Figure 9.13 for RJ jack pin assignments.* The maximum signal that can be exposed to the fault jack is 35 VDC and 10 mA. Best results are obtained with 10 mA LEDs.

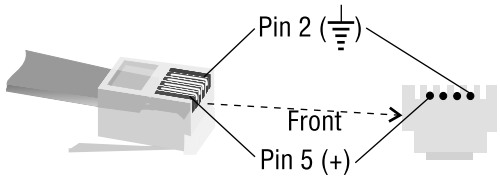


Figure 9.13 RJ Jack Wiring and Pin Assignments

* The mating connector for the RJ11 Fault jack contains 4 contact pins in a 6-slot case, as shown. For additional information please contact your local dealer or Crown Technical Support.

10 Applications

The following system examples show the flexible configuration capabilities of the Contractor Series, as well as how combinations of CH and CL Series amplifiers can be effectively used to handle varied amplifier requirements.

10.1 Restaurant

In the restaurant system example in Figure10.1, three Contractor Series amplifiers are used: CH1, CL2 and CL4.

A CH1 is used in Stereo mode, with Channel 1 set for 70V operation to power the distributed ceiling speakers located throughout the restaurant. Relatively long speaker lines without significant line-loss are possible due to the high-voltage, low-current characteristics of the 70V distributed method. Taking advantage of the flexible output options with the CH Series amplifiers, Channel 2 is set to 4/8 ohm operation to drive full-range speakers in the Bar.

For the dance floor, a CL2 is used in Stereo mode, with each channel driving two full-range speakers. The low-impedance capability of CL Series amplifiers allow multiple speakers to be paralled on each channel.

A CL4 amplifier is used in Stereo mode to drive the dance floor sub-woofers. The high power and excellent low-frequency performance of the CL4 make it an excellent choice for demanding, low frequency applications.

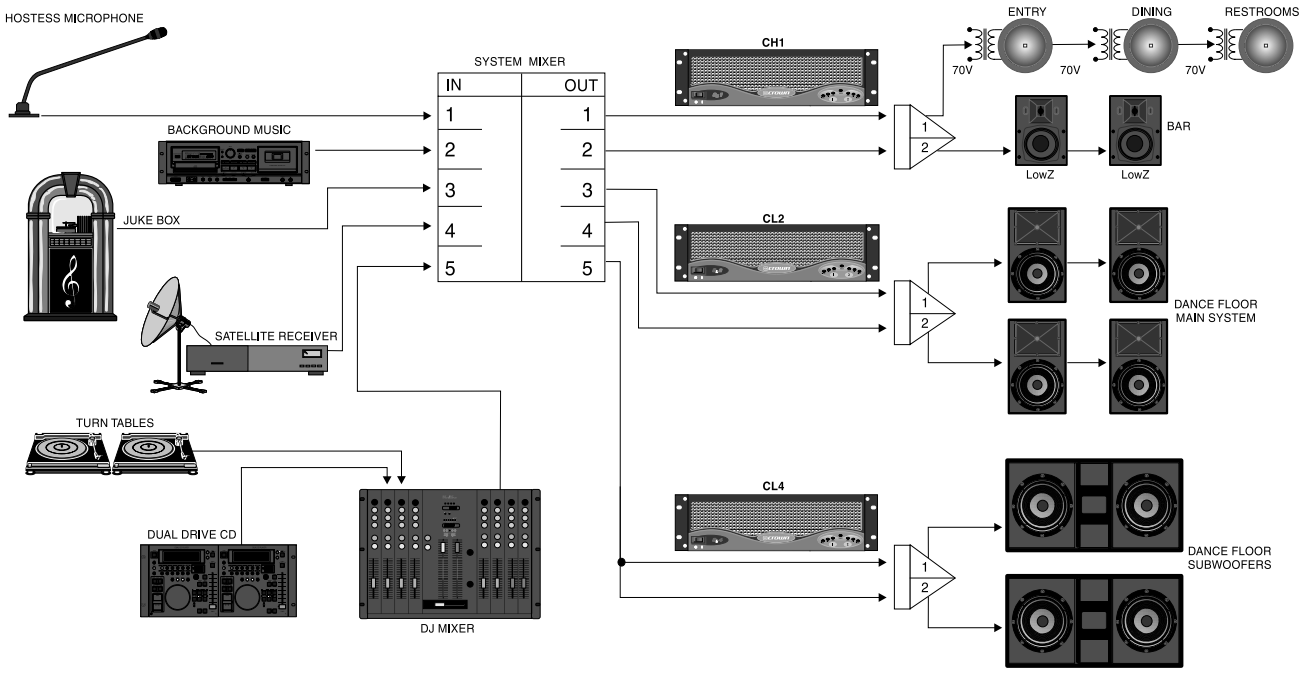


Figure 10.1 Restaurant System Example

10.2 House of Worship

CH1, CL2 and CL4 amplifiers are used in the house of worship example, shown in Figure10.2.

The CH1 is used in Stereo mode, with each channel set to 70V operation to drive two separate dristributed speaker home-runs. Relatively long speaker lines without significant line-loss are possible due to the high-voltage, low-current characteristics of the 70V distributed method.

The CL2 is used in Stereo mode. One channel will drive multiple delay speakers in a balcony. The other channel will drive multiple stage monitors. The low impedance capability of the CL Series allow multiple speakers to be paralled on each channel.

The CL4 is chosen because of its high-power capability, and is used in Stereo mode to provide channel-independent gain structure for a bi-amped full-range speaker cluster.

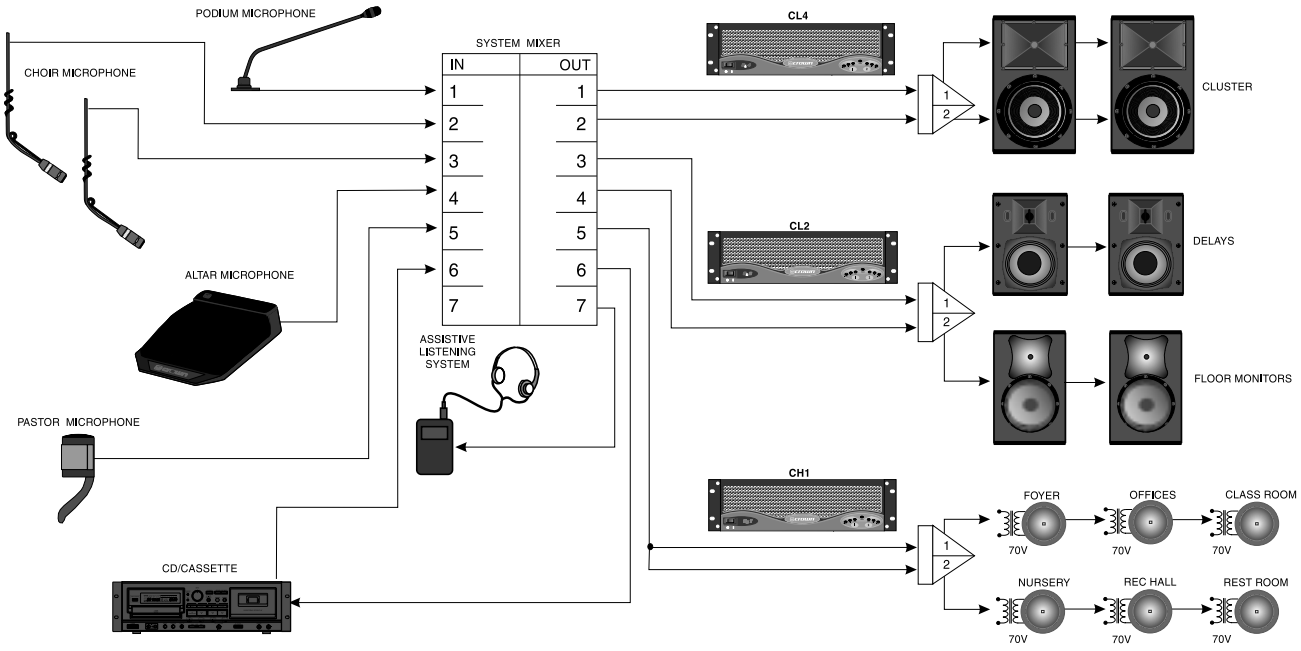


Figure 10.2 House of Worship System Example

11 Service

This unit has very sophisticated circuitry which should only be serviced by a fully trained technician. This is one reason why each unit bears the following label:

CAUTION: To prevent electric shock, do not remove covers. No user serviceable parts inside. Refer servicing to a qualified technician.

11.1 Worldwide Service

Service may be obtained from an authorized service center. (Contact your local Crown/Amcron representative or our office for a list of authorized service centers.) To obtain service, simply present the bill of sale as proof of purchase along with the defective unit to an authorized service center. They will handle the necessary paperwork and repair.

Remember to transport your unit in the original factory pack.

11.2 North American Service

Service may be obtained in one of two ways: from an authorized service center or from the factory. You may choose either. It is important that you have your copy of the bill of sale as your proof of purchase.

11.2.1 Service at a North American Service Center

This method usually saves the most time and effort. Simply present your bill of sale along with the defective unit to an authorized service center to obtain service. They will handle the necessary paperwork and repair. Remember to transport the unit in the original factory pack. A list of authorized service centers in your area can be obtained from our Technical Support Group.

11.2.2 Factory Service

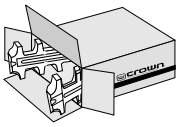
To obtain factory service, fill out the **service information page** found in the back of this manual and send it along with your proof of purchase and the defective unit to the Crown factory.

For warranty service, we will pay for ground shipping both ways in the United States. Contact Crown Factory Service or Technical Support to obtain prepaid shipping labels prior to sending the unit. Or, if you prefer, you may prepay the cost of shipping, and Crown will reimburse you. Send copies of the shipping receipts to Crown to receive reimbursement.

Your repaired unit will be returned via UPS ground. Please contact us if other arrangements are required.

Factory Service Shipping Instructions:

1. When sending a Crown product to the factory for service, be sure to fill out the service information form that follows and enclose it inside your unit's shipping pack. Do not send the service information form separately.
2. To ensure the safe transportation of your unit to the factory, ship it in an original factory packing container. If you don't have one, call or write Crown's Parts Department. With the exception of polyurethane or wooden crates, any other packing material will not be sufficient to withstand the stress of shipping. **Do not use loose, small size packing materials.**
3. Do not ship the unit in any kind of cabinet (wood or metal). Ignoring this warning may result in extensive damage to the unit and the cabinet. Accessories are not needed—do not send the product documentation, cables and other hardware.



Always use the original factory pack to transport the unit.

If you have any questions, please call or write the Crown Technical Support Group.

11.2.3 Crown's Profit Protection Plan

Your Contractor Series amplifier is also covered by Crown's advance-replacement, Profit Protection Plan, an enhancement to Crown's exceptional Three-Year, No-Fault, Full Warranty. Crown's Profit Protection Plan guarantees quick, no-questions-asked replacement of your covered Contractor Series amplifier should it fail at any time during the original 3-year warranty period following the date of original purchase.

Simply contact your local Crown dealer or distributor with model and serial number information to initiate a claim. Your dealer will supply full details on return procedures for the defective unit as well as standard and optional delivery times and methods for the replacement amplifier.

For more information on the Profit Protection Plan, please contact Crown Technical Support or your local Crown representative.

Crown Audio Customer Service

Technical Support / Factory Service
Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.

Telephone:	219-294-8200 800-342-6939 (North America, Puerto Rico, and Virgin Islands only)
Facsimile:	219-294-8301 (Technical Support) 219-294-8124 (Factory Service)
Fax Back:	219-293-9200 800-294-4094 (North America only)
Internet:	http://www.crownaudio.com

Crown Factory Service Information

Shipping Address: Crown International, Inc., Factory Service, Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, IN 46517
Phone: 1-800-342-6939 or 1-219-294-8200 Fax: 1-219-294-8124

Owner's Name: _____

Shipping Address: _____

Phone Number: _____ **Fax Number:** _____

Model: _____ **Serial Number:** _____ **Purchase Date:** _____

NATURE OF PROBLEM

(Be sure to describe the conditions that existed when the problem occurred and what attempts were made to correct it.)

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Other equipment in your system: _____

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If warranty has expired, payment will be: ❑ **Cash/Check** ❑ **VISA** ❑ **MasterCard** ❑ **C.O.D.**

Card Number:_____ **Exp. Date:**_____ **Signature:**_____

ENCLOSE THIS PORTION WITH THE UNIT. DO NOT MAIL SEPARATELY.

Detach and send with unit.